



2016

June 2016
Issue 429

YOUR EXPERT

S TECH



HACK THE WINDOWS 10 REGISTRY

GET THE PERFECT OS WITH OUR
EXPERT TRICKS & TWEAKS!

FOR
SALE

COMPLETE GUIDE:

SELL YOUR SPARE TECH



LEAN-UP & RESET OLD DEVICES SO THEY'RE
100% SAFE FOR SALE + SELLING TIPS & TACTICS



PRO LAPTOPS BENCHMARKED & REVIEWED

We put six speedy systems for work
or play through the ringer — with
some suprising winners!



AFFORDABLE ULTRAWIDE LCD

Acer's 27-inch game-ready
beauty hertz so good



GET KILLER TECH KNOW-HOW

- 10 nifty ways to re-use your old Android device
- Clean up and streamline Windows 10
- Code your own chat network
- Build a furiously-fast Core i5

TOP TECH & APPS, TESTED BY EXPERTS

- At least! A cheap and speedy Intel 6th-gen CPU: Core i3-6100 tested
- Take the Wi-Fi with you: mobile hotspots compared
- Ubuntu 16.04: Is Linux finally good enough to be your next OS?

RASP-PI ZERO MEDIA CENTRE

Use the cheapest Pi to
create a TV-ready media
player — step-by-step
instructions inside!

TV SHOWS

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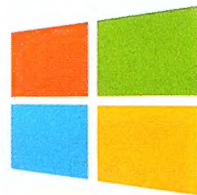
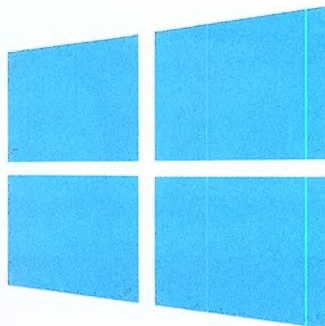
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Windows 10 upgrade: it's now or never

That is, at least if you want it for free...
APC's editor Dan Gardiner looks at
your options.

It's official: after July 29th of
this year, the Windows 10
upgrade will no longer be free
— it'll cost you \$179 a pop for
the Home edition and \$229 for the
Pro edition. That \$179 price is the
same as what Windows 10 retails
for on the Microsoft Store, although
it's about \$40 more than you'll pay
for an OEM version — i.e. how much
you pay for a copy of Windows 10
alongside a new PC.

Also notable is that all new PCs
sold after that date will come with
Windows 10, too, so if you're hoping
to get a new PC with an older version
of Windows (already a rarity), now's
the time to start hunting.

So, now that the deadline is
looming, should you upgrade? For us,
the most important aspect of that
question revolves around how long
you intend to continue using your
current system, and what edition of
Windows it has. Every version of
Windows has an official 'lifecycle' of
10 years — how long Microsoft will
support the OS with regular updates
and security patches — although this
has often been extended in the past.
Windows XP, for example, had a
lifecycle of over 12 years due to its
continuing popularity. Here are the
official expiry dates for the eligible
versions of Windows:

- Windows 7 — January 14, 2020
- Windows 8.1 — January 10, 2023

Those dates are far enough away
that you'll probably upgrade to a new
PC or laptop before then. Most people
who've used both will agree that
W10 is better than 8.1 — it brings
back the Start menu, is faster on
lower-end hardware and lets you
work more efficiently with the
traditional mouse-and-keyboard
inputs. I actually have an 8.1 system
that I'll be upgrading soon.

If you have Windows 7 and you're
happy with it, you might be able to
continue along as you are. But you
will be missing out on the gradual
improvements Microsoft makes to
Windows 10 and, as with previous
versions of Windows, there will be a
smattering of exclusive games and
apps that require it — the recently-
released *Quantum Break* (see page
112 for our review) is one such
example. If that's a trade-off you're
happy to make, you can stay put.

For anyone who decides not to
upgrade, there's some relatively good
news too: those bloody Windows 10
Upgrade prompts will finally
disappear after July 29th. Hooray! ■



DAN GARDINER
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"67% of *Team Fortress 2* players own a mask that makes them look like an adorable baby seal." Getting to the point, page 56.



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ISSUE 429, JUNE 2016

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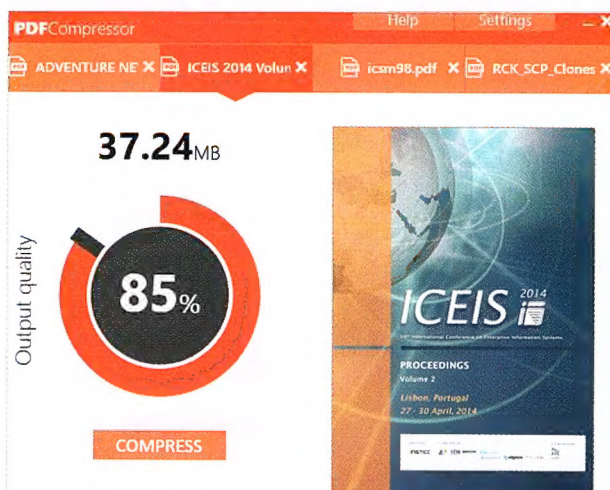
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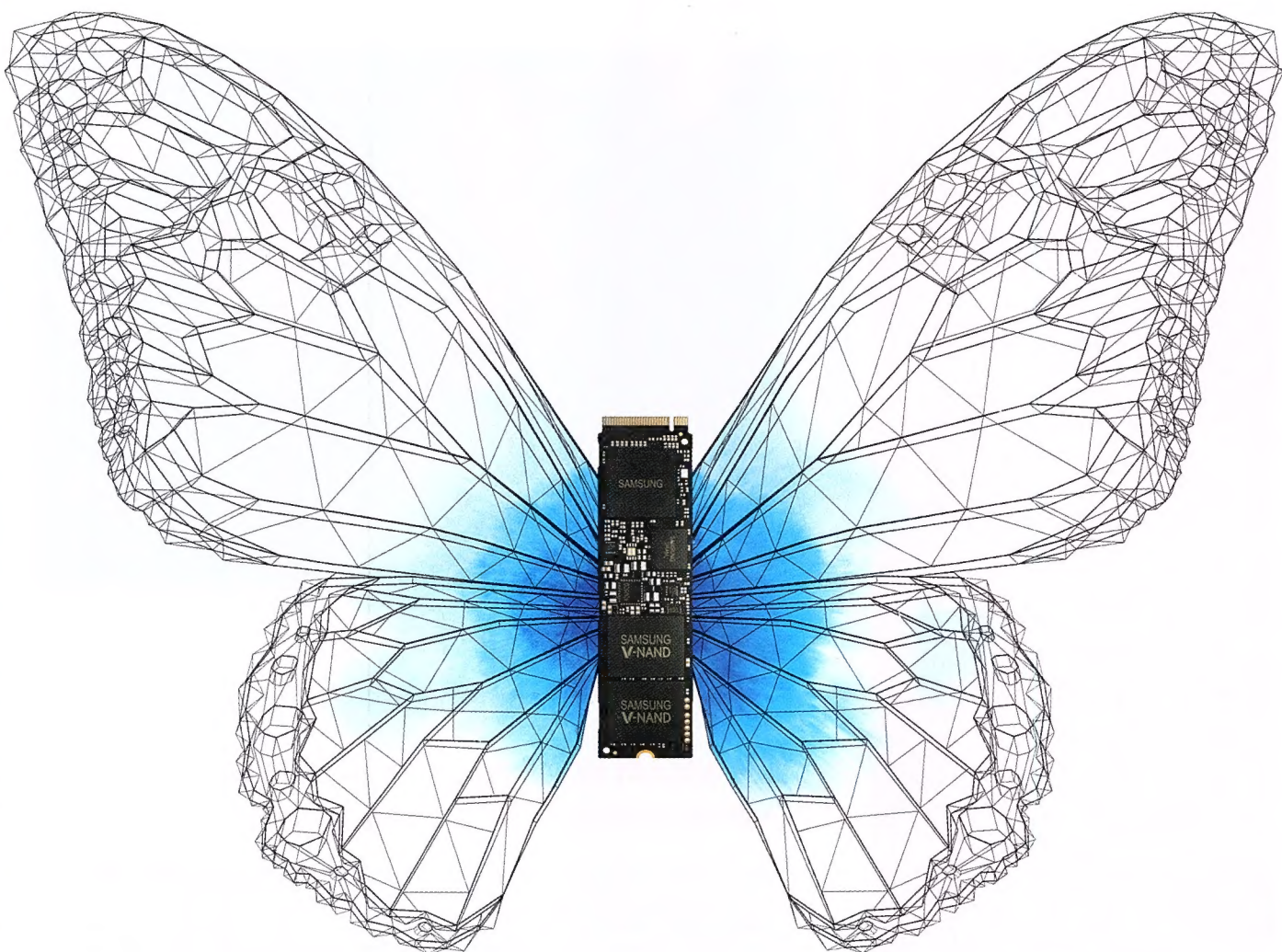
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*Performance benchmark product : 950 PRO(512GB)



Facebook-owned Oculus shrugs off users' privacy complaints

Oculus executive downplays public's concerns.

If you're concerned about your privacy when using the Oculus Rift, you shouldn't be, according to the company's head of worldwide studios, Jason Rubin. "People want to know. They have a right to ask. We'll answer. It'll be fine," said Rubin when prompted in a recent interview about the kinds of user details the Oculus Rift will collect. The comments arrive amidst privacy concerns raised by United States Senator Al Franken in an open letter to Oculus CEO Brendan Iribe in early April. "I believe Americans have a fundamental right to privacy, and that right includes an individual's access to information about what data are being collected about them, how the data are being treated, and with whom the data are being shared," wrote Franken. Rubin however, is unfazed by the senator's insistence that Oculus provide answers by May 13, stating that the company is "going to answer all of that in due time," and that Oculus is "absolutely confident that people are going to say, 'Oh. Yeah. Right.'"

Stephen Lambrechts



Geoblocking found to be anticompetitive

Aussies should be allowed to circumvent it, says Government Productivity Commission.

Think you should be allowed to watch any version of Netflix you like? Well, the Productivity Commission agrees with you – a recommendation by the governmental body has stated that not is it perfectly legal to circumvent geoblocks, it should be made crystal clear that all Australians have the right to find ways of watching blocked content from overseas if they so desire it. "The Australian Government should implement the recommendation made in the House of Representatives Committee report 'At What Cost? IT pricing and the Australia tax to amend the Copyright Act 1968 (Cth)' to make clear that it is not an infringement for consumers to circumvent geoblocking technology," said the Commission, also stating that "the Australian Government should seek to avoid any international agreements that would prevent or ban consumers from circumventing geoblocking technology". The Commission noted that Australians are generally forced to pay more for a lesser service. Given that Aussies are forced to obtain Foxtel just to see *Game of Thrones* legally, we're inclined to agree.

Stephen Lambrechts

Those dastardly hackers even want to steal your Netflix account

Hey, now, watch *House of Cards* on your own dime, fella!

A new report by Symantec has revealed that, when it comes to being targeted by ransomware, Australians now rank number nine in the world. Australia has unfortunately become a paradise for hackers, thanks in part to the country's laidback attitude toward online security, and its high disposable income. According to the report, the number of Australians affected by ransomware has risen by 141% over the last year. Hackers use ransomware to take over people's computers, so that they can encrypt their accounts and sensitive information, and then demand the victim pay a ransom (usually a few untraceable Bitcoins) to get it all back. If the victim doesn't pay, their data is sold to the black market. Though you'd certainly expect stolen credit card details to be a big ticket item in the underworld, it's been revealed that Netflix accounts have also become a big seller, with pirates setting up their own networks and charging a \$1 monthly fee. Pretty industrious for a pack of thieves!

Stephen Lambrechts



Intel smashes its Atom chip line

After struggling to compete with ARM, Intel has now effectively exited the smartphone market.

Though it's tried for years to get into the smartphone business with little success, Intel has officially cancelled its Broxton and SoFIA mobile chipsets, leading many to believe that it will exit the market. Though its Atom x3 processor series has been dropped, the Atom x5 and x7 will stay in production. Less clear is the future of Intel's Willow Trail platform, which is still awhile away. SL

Higher mouse-sensitivity could give you RSI

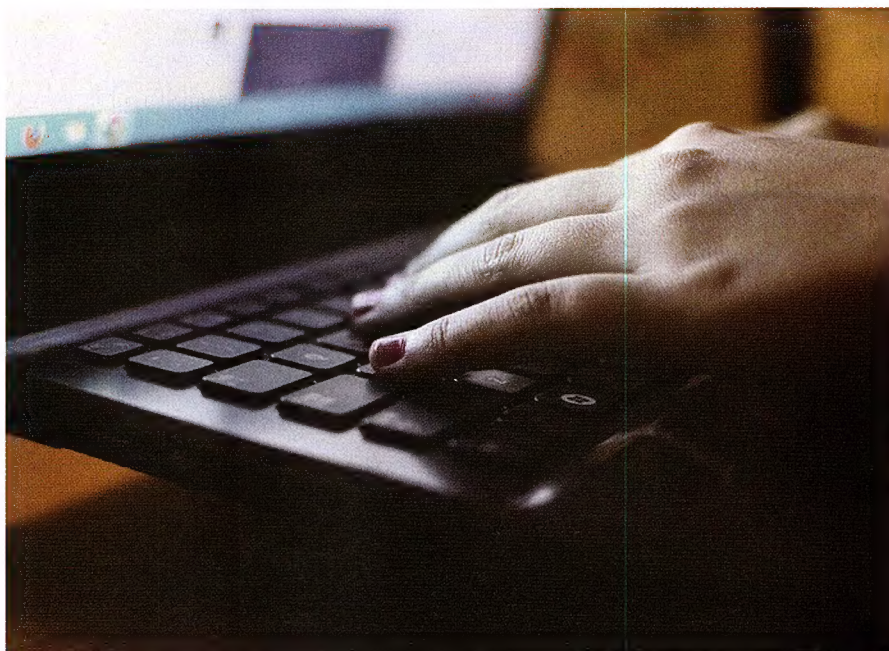
Is being great at *StarCraft* worth acquiring a long-term ailment?

While manufacturers of pro gaming accessories like to tout extreme sensitivity in their gaming mice, using them for long periods of time may be doing you harm, according to an online post by Dr Levi Harrison. As stated by Harrison, aggressive flicking of the wrist could lead to players "developing RSI including the carpal tunnel, the wrist, joints, tendons, etc". SL

No NBN, thanks

Only half of Aussies with physical access actually connected.

Though NBN Co. likes to trumpet figures stating that over two million premises have access to its network, it's been revealed that it's actually struggling to attract users, with only one million active users signing up so far. Apparently, high costs of NBN plans are the main deterrent, as well as a general lack of awareness from many potential customers. SL



Aussies fall for tech support scams more than most other types

What a pack of flamin' galahs!

According to new data from the Australian Bureau of Statistics, Aussies are more prevalent to falling for scams involving technology than most other fraudulent schemes. In the interviews conducted for its 2014-15 Multipurpose Household Survey, the Bureau found that an estimated 113,000 Australians had fallen for online tech support scams within a single year. Though fake lotteries are the most common type of scam encountered in this country, having been encountered by 30% of Australians, the rate of response for tech scams is almost two and a half times larger. Perhaps a bit more difficult to avoid is credit card fraud, which affected over a million Australians during the same survey period. The Bureau's findings revealed that of all the card fraud victims surveyed, 53% discovered the problem on their own, while the rest were informed by their bank, credit card company, the police, consumer affairs or some other agency. Identity fraud is also a major problem, with 126,300 Australians having fallen victim during the same period.

Stephen Lambrechts

Windows users, it's time to uninstall QuickTime

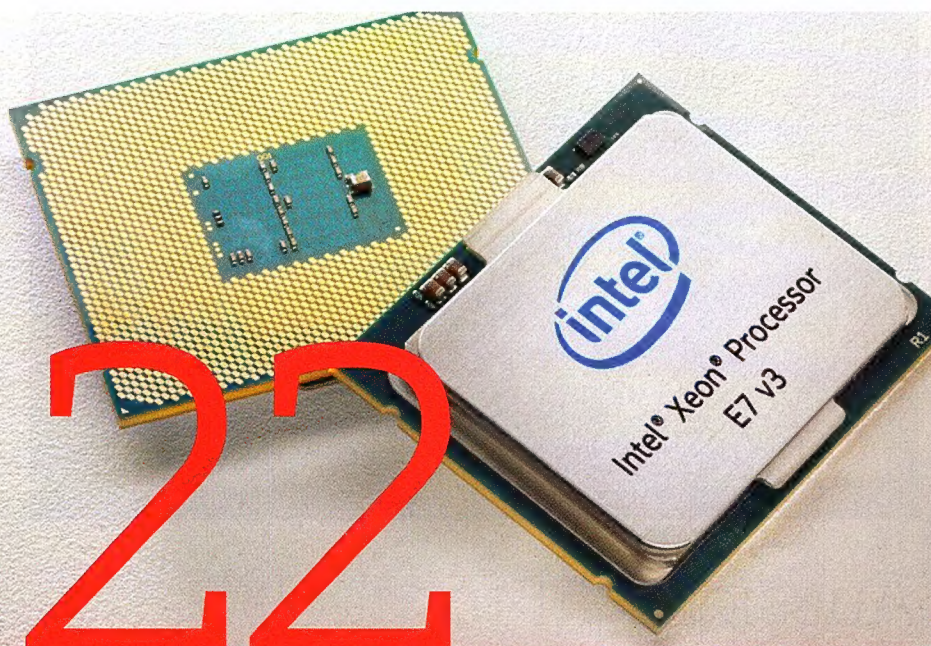
Orders straight from the US Government.

With Apple no longer supporting the PC version of Quicktime, the Department of Homeland Security has advised that PC users remove the program from their computers due to two vulnerabilities that have recently been discovered in the video app's code. The vulnerabilities could lead to "loss of confidentiality, integrity, or availability of data, as well as damage to system resources or business assets". SL



technotes

» JOEL BURGESS LOOKS AT THE NUMBERS DRIVING THE NEWS.



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THE NUMBER OF CORES IN INTEL'S BROADWELL XEON SERVER CPU.

These days, we're fairly used to hearing about dual-, quad- and even sometimes octa-core CPUs, so when we got wind that Intel had built a docosa-core CPU, we were naturally a little intrigued. Intel's top-of-the-line Broadwell-based Xeon E5-2600 v4 server CPU will set you back a cool US\$4,115, but with each of its 22 cores running at 2.2GHz, this chip will demolish highly parallel workloads. The new 14nm Broadwell architecture is also notably more efficient and powerful than the last 22nm Haswell-based server CPU range.

3 YEARS

APPLE'S EXPECTED LIFE CYCLE FOR YOUR IPHONE.

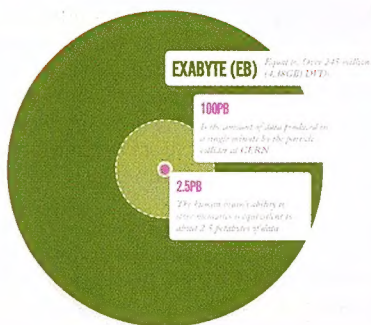
When you fork out the premium associated with Apple products, you're probably thinking your new device will want to last a bloody long time to justify what you just paid for it. But according to the company's sustainability page, Apple's banking on most customers crawling back for another iPhone after about three years. Interestingly, though, the Cupertino company extends this expected lifespan for both Mac computers and Apple TVs by another year.



71%

THE PROPORTION OF PEOPLE WHO BELIEVE THE DARK WEB SHOULD BE SHUT DOWN.

The 2016 CIGI-Ipsos Global Survey on Internet Security and Trust, which asked 24,143 respondents from 24 countries, including Australia, about their opinions on matters of cybersecurity, found that 7 in 10 people want the Dark Web shut down. Depending on who you ask, that could easily seem either high or low, but when you consider that in 2014, a University of Portsmouth researcher found that 80% of the Dark Web was related to paedophilia, we're at least partially surprised that disapproval rate isn't a little higher.



1.7EB

THE AMOUNT OF DATA AUSTRALIANS DOWNLOADED AT THE END OF 2015.

In the last quarter of 2015, Australians devoured considerably more data than ever before, smashing the previous year's quarterly total by around 50%. A good chunk of this 1.7 million terabytes of data is believed to be due to the ever increasing consumption of online streaming services. Netflix is now believed to have 2.7 million subscribers in Australia, while Stan's most recent subscriber count pegged it at 700,000.

12,000

THE NUMBER OF JOBS INTEL SLASHED IN APRIL.

Jackdaw Research analyst Jan Dawson told Re/code that, in the time since Intel launched its Atom-branded range of smartphone processors in 2012, the company had "likely lost well over \$10 billion betting on mobile chips that never really got them anywhere." The chip-maker announced in April that it would cut its losses and cancel the planned Broxton and SoFIA lines of Atom chips, effectively ending its production of smartphone chips. It's believed that this is a major contributing factor to the company's decision to cut a staggering 12,000 from its workforce in the weeks preceding the Atom announcement.

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CHEVROLET BOLT EV

AN ELECTRIC CAR FROM THE AMERICAN MANUFACTURER.
CHEVROLET.COM | US\$30,000
(UNDER CONSIDERATION FOR AUSTRALIA)

Electric cars. Less pollution, less expense... What's not to like? Well, there have been concerns about lack of power, both in terms of acceleration and battery performance, but with newer models, you can park those fears. Chevrolet's all-electric Bolt boasts a 200-mile range on one charge, can reach 60mph from standstill in less than seven seconds, and offers a top speed of 91mph (146kmph). As well as a clever motor, there's plenty of smart tech going on in the cockpit, too, with displays for battery levels and climate control, and it plays nicely with CarPlay for calls, navigation and more.



PLANTRONICS RIG 4VR

VR 4EVR
\$119 | WWW.PLANTRONICS.COM

Although Sony's PlayStation VR kit won't be available until October, Plantronics is attempting to get out in front of the console's virtual reality system by releasing an audio headset specifically for the VR add-on. The Rig 4VR's headband and oval ear cups have been especially tailored to accommodate the halo-like PSVR headset and aim to give you a more immersive VR experience. According to the company, the headset will offer swappable components like its 500 series headsets, allowing you to add the elements that suit your personal preferences. [JB]



RAZER LEVIATHAN MINI

TAKING THE RAZOR TO THE LEVIATHAN SPEAKER.
\$249 | WWW.RAZERZONE.COM

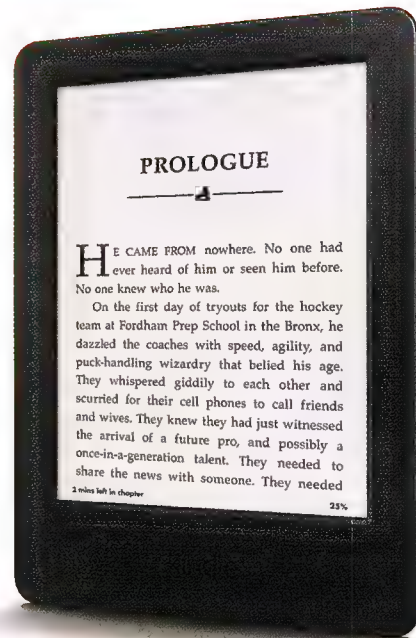


Razer's full-sized Leviathan soundbar received some rave reviews when it released last year — it's a 5.1 sound system that was specifically pitched at PC gamers — and we're hoping the company can impress again with this new miniature version. With Bluetooth 4.0, NFC quick pairing and a 2,600mAh battery that gets a reported 10-hour lifespan before requiring a recharge, it looks good on paper... albeit more like a portable Bluetooth speaker than a soundbar. You'll be able to daisy chain two Leviathan Minis for louder stereo sound, and while the stylish chassis is on the smaller side, the two 12W speakers inside shouldn't have any trouble making some big sound. [JB]

AMAZON KINDLE OASIS

LUXURY KINDLE WITH LEATHER COVER/
CHARGER.
WWW.AMAZON.COM | FROM US\$309.99

The Oasis is Amazon's thinnest and lightest Kindle yet, and boasts that its new ergonomic design will let you read more comfortably for longer. That leather charging cover comes included and adds a staggering seven weeks to the battery life, bringing it up to nine. If you do need to take the cover off, it's fairly easy to do and the Oasis feels great to hold 'naked', thanks to one side being weightier than the other. The glass has had a subtle redesign, with cylindrical etching that is meant to scatter light reflections better. However, it isn't waterproof (so watch out poolside or at the beach). [CS]



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SMART DICTATION VOICE RECORDER.
TINYURL.COM/APC429-VOICE | \$999

This Android-powered device fits into your pocket as easily as the old-school iPhone it resembles. It's simple to use from the comfort of your workstation or on the go, thanks to the distinctive and cleverly designed buttons on the side so you can quickly catch audio or video without having to waste time flailing around looking for the right app. It sports a touchscreen, a camera on the back and three 360-degree microphones. Transferring files to your computer can be done via Wi-Fi, Bluetooth or by the rather chunky dock included. For those who need a dedicated dictation device, this is a very stylish option — but also a rather pricey one. [CS] ■





Valve Steam Controller

Don't take this simple design for granted — if anything, it makes it easier to fix.

BACKGROUND:

Every once in a while, cloud software giant Valve tries its hand at hardware — see the Steam Machine. This time, it's promised to revolutionise the way we game with its Steam Controller. The company has impressed us with highly modular tech in the past, so let's find out how much game this controller has.

MAJOR TECH SPECS:

- High-definition haptic feedback
- Dual trackpads
- USB 2.0 via micro-USB port
- Six-axis combination gyroscope-accelerometer sensor
- Dual-stage digital triggers with 10 degrees of travel, magnetic flux sensor, and tactile switch
- Up to 80 hours of gameplay from two removable AA batteries
- Five metres of wireless communication range

KEY FINDINGS:

- The rear cover snaps off with no tools required to reveal the model number: 1001. After rooting around the battery compartment, we punch through the sticker on the back to find three T6 Torx screws. With the rear housing removed, we get our first look inside.

- Underneath the rear casing, we find a couple of battery eject levers. Frequent battery replacements means less time not playing. While battery eject levers are nice, what we're interested in is Valve's decision not to use an integrated battery.
- It's a trap! Lifting the motherboard out of its housing reveals a couple of hidden ribbon cables connecting the touchpads to the underside of the board. Removing the mobo without dispatching these cables will increase your repair woes.
- We use a plastic opening tool from our new Pro Tech Toolkit to bust the touchpad out from its bracket bars. The ribbon cable plugs into a socket on the touchpad daughterboard and is soldered to the haptic feedback actuators. The brains of the operation is a Cirque 1CA027 companion MCU.
- The dual-stage trigger can be broken down into two stages: the first is the smooth motion of the trigger when pressed. The magnetic flux sensor measures the position and speed of the trigger based on a time-varying flux. The second part is the click when the trigger presses a button on the mobo.
- Repairability Score: 8 out of 10 (10 is easiest to repair). The only adhesive

About iFixit

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit www.ifixit.com.

we encountered was on the touchpads. All other mechanical connections are made with screws. The Controller's modular construction means replacing a single component is a simple task. While we always say screws before glue, the non-magnetic screws here are apt to get misplaced. The most likely-to-fail component, the thumbstick, is soldered directly to the motherboard. ■



Dual motion triggers — ooh, fancy!



Even the ribbons have 'Valve' written on them.

THE

MOST FUN

YOU CAN

HAVE WITH

YOUR HANDS

WITHOUT

GOING

2000

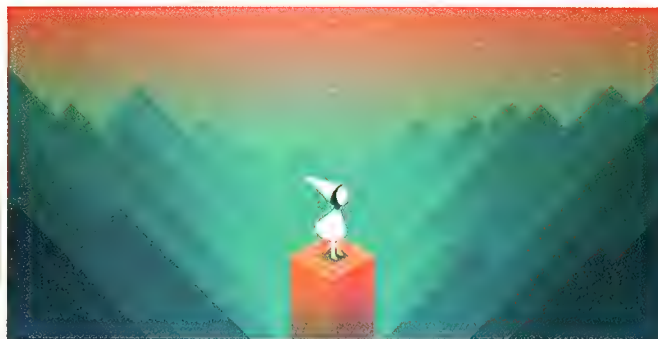
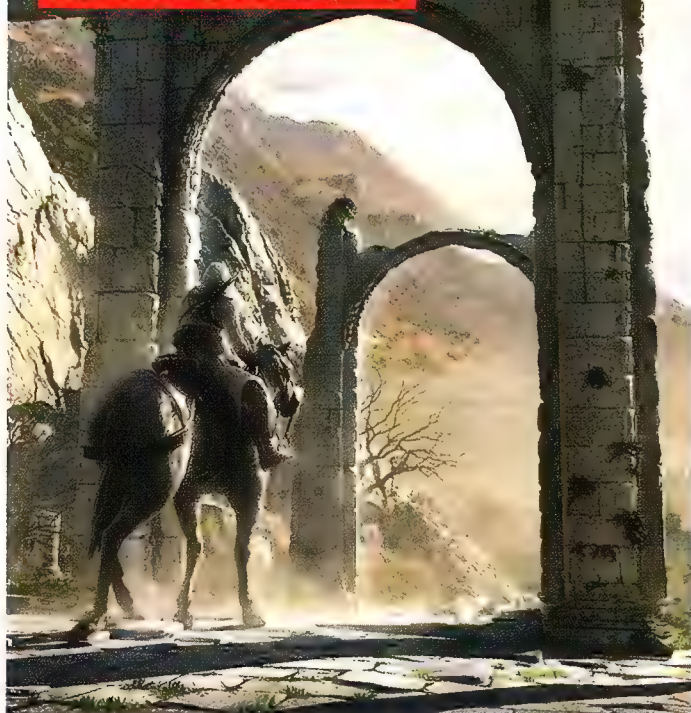
games
radar

MORE KICKS PER CLICK

technotes

EPINIONS

"Assassin's Creed has even been used in the University of Mississippi to promote source criticism and historical debate"



VIDEO GAMES ARE GOOD FOR YOU

For many years, video games have been criticised for making people anti-social, overweight, depressed or violent. This stops now! Because researchers are now saying that games improve both body and mind.

According to studies by the British Council, preschool children who play on the Wii appear to have better-developed motor skills. This suggests that games can actually combat obesity, if played in moderation. Computer games are not just about

punching and shooting people, either – they can also be used for learning. Games like *Assassin's Creed* have shown to spark interest in history for many people, inspiring them to expand their knowledge. Despite the many inaccuracies of the first game, *Assassin's Creed* has even been used in the University of Mississippi to promote source criticism and historical debate.

Plus, not all gamers are loners. A study by gamestudies.org has concluded that gamers who play multiplayer games (such as *Battlefield*

and *Call of Duty*) are actually 50% more approachable and social, and that games can help forge friendships. *World of Warcraft* also teaches kids how to multitask, as it requires them to chat by voice, chat by text, operate a character and manage short- and long-term objectives.

Games have also been proven to help increase problem solving skills. *The Witness*, *Monument Valley* and *Portal 2* are great examples of this. Not to mention that games make you feel better about yourself.

Emmanuel M (primary-aged student)

APCMAG@FUTURENET.COM

Come on, have your say!

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technotes

» END USER



The Panama Papers and the privacy double standard

Governments are eager for a backdoor into our private lives, but are they willing to respond in kind? Shaun Prescott reports.

For those among us who remain ambivalent towards questions of surveillance, the common refrain is that 'if you're not doing anything wrong, there's nothing to worry about'. This implies that any government or corporation's access to an individual's private information – the type that would have been inaccessible or offbounds in the pre-internet age – is nothing to worry about because, after all, if you're doing something bad, you ought to be caught anyway.

Arguments for and against this attitude are many, and whichever side you happen to fall on, one thing seems certain: those in power accustomed to protection from these quandaries – indeed, even those who serve to erode individual privacy in the modern age – don't like to be caught out on the wrong end of it.

Take, for instance, the Panama Papers, a motherload of classified documents leaked in April. These detailed the operational matters of

over 200 companies responsible for facilitating offshore tax havens. The 11-million-plus documents are still being pored over by journalists, but one of the first major stories to emerge from the documents was an indirect damning of British Prime Minister David Cameron. Cameron's deceased father was shown to hold an offshore trust fund based in Panama, and Cameron later admitted that he had benefited from it. Still, he was also adamant that his father's involvement was "a private matter", i.e. not one in the interest of British voters. Meanwhile, the leader of Iceland was forced to resign following the leaks.

During an age when ostensibly democratic Western governments are taking corporations to court in order to ensure access to the private data of its citizens, this is the height of hypocrisy. The irony wasn't lost on NSA whistleblower Edward Snowden, who snarkily drew attention to the double standard on his Twitter account. Of course, many would argue that

governments and public servants are entitled to a certain degree of privacy, by dint of their access to knowledge with national security implications. Whether Wikileaks should consider the effects of its leaks related to ongoing conflicts – such as it did in 2010 with the Afghan War leaks – is constantly up for debate, as these can have a far-ranging influence on the lives of those involved.

Still, David Cameron's indirect profiting from an offshore tax haven is certainly not a matter of security: it's proof that among an increasingly ubiquitous chunk of the political class, dodgy profiteering isn't a problem so long as no one kicks up a fuss. When someone does, and when the prime minister of one of the world's most powerful economic leaders is implicated, then it's written off as "a private matter".

That is, if only in principle, why individual privacy issues ought not to be passed off as the province of torrenters and drug dealers. ■

ENDUSER

Share your stories!

If you have an interesting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at apcmag@futurenet.com. All correspondence becomes the property of APC and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

technotes

INSIDE APC



Inside APC

Find out all about APC's editorial policies, test practices, how to read the benchmark results and more.

APC is Australia's oldest consumer technology magazine – having been consistently in print for over 35 years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer – it's in our name, after all – the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech too, from smartphones and apps to peripherals, accessories, online services and beyond. We have two main goals: to track down the best of modern tech and also to help our readers make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And like you, APC's journalists want to know what's good in tech – no matter what platform it resides on.

INDEPENDENT REVIEWS

Championing technology doesn't mean we're unrelenting yes-men, however, and APC aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three.

As a matter of policy, reviews published in APC are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an APC reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

LABS TESTING

Despite being a small magazine with limited resources, APC still strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance, gaming and battery life.

In most cases, for the benchmark results published in APC, you can assume that higher is better. There are certain tests that deviate from this rule and where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter are our preference due to their ease-of-readability, but tables are more compact, so we use these in cases where thoroughness is preferred.



TABLET

FROM \$899 | WWW.APPLE.COM/AU

Apple iPad Pro (9.7-inch)

Apple's smaller 9.7-inch iPad Pro still offers phenomenal power, now in an more compact and portable package.

Packed into a body the size of the incredible iPad Air 2, the iPad Pro 9.7 manages to take the monstrous iPad Pro and shrink it down without any significant sacrifices.

Aesthetically, there's not much different to 2014's iPad Air 2. From the front, and with the new True-Tone display switched off, you will struggle to tell the two apart. Get one in your hands, though, and you'll notice a couple of key differences – the inclusion of the four rear speakers in the back corners of the device, and the smart connection port on the bottom of the Pro 9.7 will reveal its technological developments. Switch on the display and things become even clearer – while the resolution is the same, the auto-correcting white balance of the Pro's True-Tone display makes it easier to read.

Also packed into the Pro is the iPhone 6S's 12MP rear

camera, complete with True-Tone flash. The front-facing camera also matches the iPhone's with a 5MP camera perfect for FaceTiming. While on par with Apple's smartphone family, that doesn't mean it's the best camera for every situation. Instead, the improved snapper offers a new level of quality for app developers to take advantage of.

The extra grunt of the A9X chip, which first appeared in the iPad Pro, works a treat. Even the most graphically intensive apps, which can render and scale complex 3D models in real time, operate without so much as a hiccup. Apple's marketing pushes the iPad Pro lineup as laptop-replacing, and while we wouldn't go quite that far, if your software needs are met by the App Store, there's a lot of practicalities about using this for work.

Even iOS 9's multitasking features manage to work well. Drag the screen from

the edge and you can run two compatible apps concurrently. That said, it only supports two concurrent apps, and isn't really 'multitasking' in the same way you multitask on a computer.

But the real point of difference here is the support for Apple's Pro tablet accessories – the Smart Keyboard and the Apple Pencil. Like the 12.9-inch Pro, the 9.7's screen has an adaptive refresh rate that allows the Apple Pencil to have an incredible amount of responsiveness, perfect for anyone who likes to draw or handwrite. Mind you, it's pretty sad that there's no handwriting recognition built in to the Pro given its support of the Pencil, but it's not a dealbreaker.

The keyboard, meanwhile, feels a little cramped. The keys still manage to give a satisfactory tactile response – but it's nowhere near that of a dedicated laptop's keys.

The real challenge of the iPad Pro 9.7, though, is in the price. With 32GB costing \$899 and 256GB setting you back \$1,399 – and that's without the \$229 Smart Keyboard and \$165 Apple Pencil – the cost of this gets up to MacBook Air levels, but without quite so much versatility. Given the price cuts to the still-solid iPad Air 2, that older model will be the more appealing option for those on a budget.

In short, if you're after the best iPad you can buy right now, you'll have to pay for it. As always.

■ Nick Broughall

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

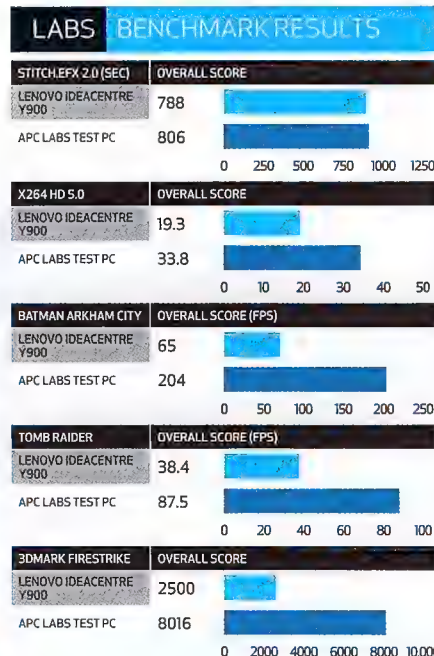
This is undeniably a pro device that's priced for pros, but it does deliver on most of its promises.





GAMING DESKTOP

\$2,999 | WWW.LENOVO.COM



Lenovo Ideacentre Y900

Well, it's an OK idea...

Lenovo may be the largest PC seller in the world, but it isn't a household name as far as PC gaming is concerned. The Chinese company wants to change that, especially as it pertains to the desktop space. Enter the Ideacentre Y900. The mid-tier desktop line features an edgy and aggressive design, but doesn't look too gaudy. A good Ideacentre or just a bad idea? Read on...

The Ideacentre Y900 uses a mid-tower chassis, and has some sharp edges, fancy red lighting and a carbon fiber aesthetic, which gives the package some pizzazz.

The side doors open unconventionally, and took us a second to figure out. Not only is there a latch on the back that you have to release, but there's an unlock button on top for the side doors. Once you open up the case, you'll notice that the guts include an Intel Core i7-6700K CPU, 8GB RAM, and a GeForce GTX

970. While we would have preferred 16GB RAM, there are two empty DIMM slots if you want to add more. The specs also make this VR-ready.

For storage, the Y900 comes with a 2TB hybrid HDD, but there's no SSD in this base \$2,999 model. You can upgrade to a 256GB SSD (along with a GTX 980 graphics card and 4GB of RAM), but that'll set you back an extra grand. For cooling, the Y900 uses an interesting red-glowing air cooler that we've never seen before, coupled with a glowing red 12cm exhaust fan at the rear of the case. Everything is powered via an 80-plus bronze certified 625-watt PSU.

When it came time to use that firepower, the Y900 performed modestly compared to our APC Labs Test system. To be fair, it has three GTX 980s and a 5960X CPU. In single-threaded CPU tests, performance was roughly on par. When it came to the multithread-

heavy x264 test, however, it performed 43% slower. Ouch! But we are comparing an octa-core CPU against a quad-core one here.

In graphics, the delta was even bigger, as you'd expect. Across the board, we saw a delta of 56-68%. This means you'll be able to max-out almost everything at 1080p, and even some games at 1440p, but it's far from a 4K rig. For fun, we also ran the SteamVR benchmark, and the Y900 garnered a 6.4 fidelity score, which just barely puts it in the 'high' tier ('very high' is the best). This means it should be able to play most games on high in VR, but don't expect to max-out settings.

While our unit costs \$2,999, which is expensive for a system with these specs, it also came with a mechanical keyboard, gaming mouse and USB headset. The keyboard uses Kailh switches that feel like red/brown ones; they aren't super-loud, like blue or green switches. The headset

uses a USB interface, feels super-comfortable, and sounds competent. It also glows and has a removable mic. We weren't as enamored with the mouse, however, which is a little too bulky for our taste.

While the Y900 isn't a bad starter kit for the aspiring PC gamer, and does come with decent peripherals.

There is a price premium to pay, especially if you have your own gaming gear, so it's up to you whether this is what you want. This isn't a great Ideacentre, but you could do worse.

■ Jimmy Thang

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Comes with peripherals; VR-capable; edgy but not gaudy.





VENOM

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LAPTOP

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Apple MacBook (Early 2016)

Apple's tiny notebook gets faster. A little bit.

The new MacBook was something of a revelation for us last year. With its low-power (and, therefore, low-performance) Intel processor, single port for power and data, and ridiculously thin and light profile, we thought it might turn out to be like the first-generation MacBook Air: a stunning concept that would need a few generations to mature.

But we'd underestimated it: not only was it plenty powerful enough for light use, but its fanless operation, Retina screen and smart new keyboard and trackpad made us totally fall in love with its usability. Now we've got a second version, with a more powerful processor, faster storage, and a bit longer battery life.

First, the processor. Intel's new chip is between 10% and 20% faster, depending on the benchmark. This isn't a huge leap forward, but it's combined with speed

improvements to reading and writing its flash storage (in our tests, write speeds went up by 40% to 633MB/s, while read speeds improved by about 20% to 930MB/s). Plus it has faster RAM. These add up to make it feel more responsive than last year's model, together with a better graphic card for smoother animations.

Okay, it's still going to struggle if you're thinking about using it as an advanced Photoshop or high-end video editing machine, but for making tweaks in Photos or simple iMovie projects, it's plenty fast enough.

This is a lightweight machine for lightweight computing. The 2,304 x 1,440 12-inch Retina display is sharp and vibrant. The battery life has been improved over last year's model, by an hour – and it was already excellent.

The Force Touch trackpad is great to use, and we're big fans of the new keyboard. The large keys are easy to

"Now we've got a second version, with a more powerful processor, faster storage, and longer battery life."

type with accurately, and we find their clicky feedback pleasant once you get used to it. And with no fan, it's utterly silent – great for using in front of the TV or on your lap in bed while your spouse is asleep. I mean...

However, there's still the matter of it having only a single USB Type-C port (plus a headphone jack). If it had one USB port and a power connection, we wouldn't have a problem. As it is, taking it on the road probably means carrying adapters, which makes it a less portable package and portability is kind of its main selling point.

Still, despite its issues, this new MacBook (which now comes in silver, gold,

space grey and the above pictured rose gold colour choices) does offer users a lightweight, powerful and speedy option for not-too-demanding tasks.

■ Matt Bolton

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

An excellent, fun, lightweight machine, now with added speed and longevity – but its issues haven't changed.





CPU

\$169 | WWW.INTEL.COM

Intel Core i3-6100

Is this dual-core 14nm a monster bargain?

Skylake is a curious beast. On one hand, it's progressive, advanced and capable of handling the gloriousness of the Z170 chipset. On the other hand, it's pricey, doesn't offer a huge boost in performance over its predecessor and was tricky to get hold of when it launched.

Let's be honest, this CPU isn't for gaming or high-end computing, certainly not for the vast majority of us. Since you're reading this, you're either already well-equipped or looking to get, at the very least, a Core i5 for gaming. If not Skylake, then Devil's Canyon or Haswell.

So what is this for? DIY NAS systems, Steam streaming rigs, sitting-room gaming stations and home theater machines.

And what's the difference between the \$169 Core i3-6100 and its \$329 Core i5-6600 compadre? Well, the i3 features two physical cores versus the i5's four —

though hyperthreading does bump that up to four logical processors — it has half the amount of L3 cache, and its TDP is 40W lower. Otherwise, you get the same Intel HD 530 Graphics, the same support for DDR4/DDR3, and the same access to those 16 PCIe 3.0 lanes.

So when you consider that the Core i5-6600 has a base frequency of 3.3GHz against the i3's 3.7GHz, you might be asking why the i5 is so much better. It comes down to the limitations of logical cores.

A good way to think of hyperthreading is like this: a physical processor is a mouth and a single hand. That hand can feed the processor once every cycle. Add hyperthreading and you essentially add an extra hand (or a logical core), enabling you to use two hands to feed the same mouth. Although it's not as effective as having two mouths, it's still a lot faster than just using one hand.

Does this show up in testing? Yep. In almost all of

our computational tasks, the i3-6100 was far slower than its i5 counterpart. In CineBench R15, the difference was close to 200 points. HWBot's x265 benchmark saw a difference of 5fps, and in game, over four separate titles, the average frame rate dropped by 13–15fps.

But this isn't a triple-A gaming core. Nor is it a high-end processor for render workstations. Where the Core i3-6100's strength lies is within entry-level systems. It's great for older titles or less intense games, such as MOBAs and MMOs (cough, WoW). For an office and email PC for your grandma, it's ideal. And we can't forget about that power draw. Even with our meaty test system — with 32GB of DDR4, a Samsung 950 Pro, GeForce GTX 980 and ASUS Maximus VIII Formula — under load, the Core i3 pulled 22W less than an i5-6600K, and remained a constant three degrees cooler, too, making it ideal

for a do-it-yourself NAS or home theatre PC.

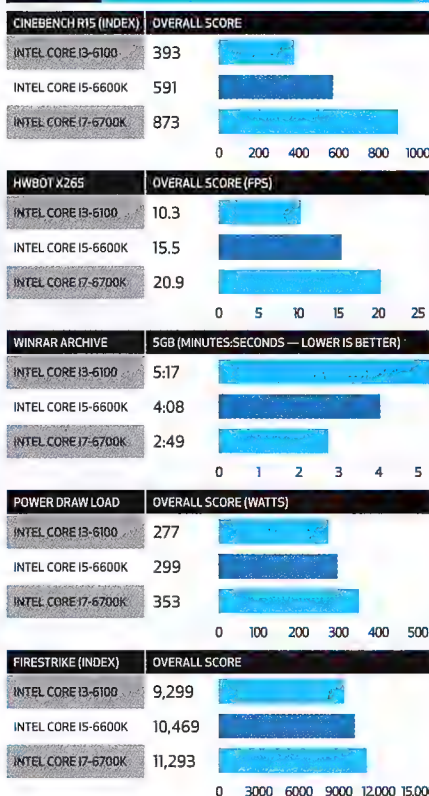
But is this a good CPU? Well, that depends entirely on your perspective, and what you need.

For HTPCs and living-room gaming, definitely. For triple-A titles and gaming at 4K, definitely not. For hardcore simulations, 3D renders, and intensive applications, of course not. But you already knew that.

For the price, it's a strong entry-point processor, a good all-rounder, and for that, we're more than happy to score the Core i3-6100 a solid four out of five.

■ Zak Storey

LABS BENCHMARK RESULTS



Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Great NAS solution; good for streaming; capable office processor; low power consumption; support for Z170.





CPU

\$158 | WWW.AMD.COM

AMD A10-7860K

AMD's most efficient processor yet.

This company has managed to make the most out of that 28nm architecture. We've seen power consumption and thermal TDP fall without the need for a smaller skin. Yet efficiency isn't everything – performance is still king, and although the continued refinement is impressive, it's that transistor size that is ultimately holding AMD back.

The AMD A10-7860K is a shining example of what you can piece together on a budget. It's not a processing powerhouse, but it's not meant to be. It's precisely aimed at the foreheads of everyday general computing and entry-level gamers. Yet, it's still an interesting and useful bit of hardware.

If you're looking for a quick and easy budget build for a friend, someone who enjoys MOBAs or simple games (in terms of graphical fidelity), such as *League* or *CS:GO*, this should be your first port of call. It's quite

easy to assemble a machine with this at its heart for around \$500, including a tiny SSD, 8GB of RAM, a 1TB HDD and a snazzy case. And for those titles, that's all you really need. This is aimed at the budget builders.

As far as performance goes, the A10-7860K is a bit of a beauty, certainly for \$158. Integrated GPU performance came out on top in comparison to all of Intel's offerings, at a whopping 1,211 points in Firestrike, almost 120 points more than Intel's HD520 graphical packages from the likes of the Core i7-6700K, and 300 points more than the entry level Core i3-6100. However, when it came to utilising a dedicated GPU, the 7860K struggled, losing out by 2,000 points in Firestrike versus the i3-6100 – a little disappointing, but not exactly too far from what we expected.

The real bottom smacker was power draw. Our test bench is nothing short of

monstrous: 32GB of DDR3 at 1,866MHz, a GeForce GTX 980, two SSDs (500GB and 2TB), all running off a BeQuiet! Dark Power Pro Platinum 1,200W PSU. Yet even here, we only managed to pull 50W from the wall at idle; that's 12W lower than every Intel CPU we've tested so far. At load, it did even out a little, with the 28nm core pulling 300W total, matching it up with an Intel Core i5-6600K, but still impressive, certainly when you consider that DDR3 runs at 1.5V, as opposed to DDR4's 1.2V, and trust us on this one – that voltage change makes a difference.

Processing power, on the other hand, well, it's where you'd expect it to be. In our testing, it's about as good as one of the old-school Ivy Bridge i3s from yesteryear. Scoring 280 points in Cinebench R15, and taking a whopping nine minutes to fully archive our 5GB test folder, it's a bit of a bummer, but that's not what this core is for.

It's a low-powered integrated gaming processor, capable of playing entry-level titles fairly comfortably at 720/1080p. Hell, it would even work well as a mini home theatre PC for those looking at that route.

And it gives us hope. Hope that AMD can take the lessons it's learnt in optimising processor design, and apply them to the zany 14nm architecture currently in development. Hope that, finally, it can give Intel a run for its money, and bring a little balance back to the Force.

■ Zak Storey

LABS BENCHMARK RESULTS



Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Hugely efficient for 28nm; great for entry-level gaming; affordable.



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D-Link DIR-510L

This portable charger and mobile router could be D-missing-Link.

If you travel a lot or just happen to be really good at draining your phone battery, keeping a power bank handy is almost a necessity. Pair that bank with your very own portable Wi-Fi router and you've got a tool that's a perfect companion for anyone who doesn't want to be held back by only having access to an Ethernet connection or needing to share a Wi-Fi hotspot.

This travel router/power-bank device category hosts a few combinations: D-Link's DIR-510L has two 5V USB ports — one 0.5A for charging phones and connecting USB storage devices and an additional 1A USB port that it says can charge devices up to the size of tablets. There's no built-in Internet connectivity in this device — you need to plug it into an Internet-connected Ethernet, or you can use a USB modem with a SIM card.

If you have devices that can connect to it, having 5GHz 802.11ac Wi-Fi is not only faster, but also allows

you to avoid using the congested 2.4GHz bands. The indoor range on the DIR-510L's 5GHz band is decent too, reducing the -45dBm signal to a usable -75dBm over 10m through a couple of timber walls.

The DIR-510L allows for wireless storage through plugging a USB hard drive into a USB port, but the accompanying software is too cumbersome to make it genuinely useful for anything other than backing up files from your phone.

With a 4,000mAh battery, it's hard to deny this device's usefulness; but considering the MobileLite Wireless G3 (right) costs half as much, we wonder if the slightly bigger battery and more compact exterior warrants the cost.

■ Joel Burgess

Verdict

An excellent device that could do with a price reduction and slightly better file transfer software.



MOBILE ROUTER

\$79 | WWW.KINGSTON.COM

Kingston MobileLite Wireless G3

Reroute your travel tech.

In addition to being a portable power bank, 5GHz AC Wi-Fi router and a USB storage device, the MobileLite Wireless G3 also fancies itself as an external SD card reader. While it might sound like the Swiss Army Knife of travel routers, attempting to do too many things can often lead to a lack of performance across the board.

Fortunately, other than the usual underwhelming file transfer and backup software that seem to come with all of these types of devices, the MobileLite Wireless G3 is surprisingly good. The MobileLite Wireless G3 has just one 2A USB 2.0 port that can be used for either charging or as a USB storage expansion, and although the 3,250mAh capacity of its lithium-ion battery is a step down from the 4,000mAh battery of D-Link's DIR-510L, there's still more than enough power to give your device a full second wind. Kingston makes little mention of the

speed ratings for each of the MobileLite Wireless G3's 2.4GHz and 5GHz Wi-Fi frequencies, yet the device managed to provide similar practical speeds as D-Link's more expensive DIR-510L.

Travelling is when SD card readers become particularly useful, but many of today's ultra-portable laptops and hybrid tablets are too small to have a dedicated SD card reader, so Kingston's inclusion of one here is a useful bonus.

Although Kingston's entry-level portable power bank router is slightly bulkier than the DIR-510L, the MobileLite Wireless G3's reasonable price, decent battery capacity and the additional SD card reader give it an edge against the competition. ■ Joel Burgess

Verdict

An affordable offering that punches above its weight and has some clever perks.





PC CASE

\$128 | WWW.FRAC TAL-DESIGN.COM

Fractal Define Nano S

More mini-ITX madness from the Swedish chassis manufacturer.

How on earth has Fractal managed to build such a good-looking, feature-rich chassis for such a low price? This tiny tower is available for less than an orange spray-tan and a blonde toupee.

The chassis is not the gaudy, pointed, LED-littered affair of a gaming chassis. The sharp lines synonymous with Fractal's minimalistic style work wonders on the Define Nano. For cooling, you're graced with a choice of up to four 140mm or 120mm fans (two in the front, two in the roof), and a final 120mm in the rear. Thanks to the Nano's barren interior layout, water-cooling should be a dream.

Additional features aren't exactly lacking, either. You can mount two 3.5/2.5-inch drives, there are some lovely rubber grommets, Fractal's personalised Velcro straps for cable management, a very swanky magnetic sliding underside dust filter, a magnetic door latch dust filter in the front, a

ModuVent cover on the top, to allow for more airflow and cooling options, and sound-dampening material embedded into that rear panel, plus pre-drilled holes for pump and reservoir mounting. The plastic front has the advantage of being fingerprint resistant. If you're not keen on the window, you can opt for a version without.

One thing we do miss is the PSU cover, and the window feels as though it could have been a touch bigger. And it still has compatibility issues when it comes to motherboards.

In reality, mini-ITX boards are a nightmare, and unlike their ATX brothers, they're not designed to mount vertically in a case.

■ Zak Storey

Verdict

Fantastic value; sleek design; great cooling support; vast range of features.



GAMING HEADSET

\$159 | WWW.HYPERXGAMING.COM

HyperX Cloud Revolver

Return of the king?

There's little doubt that HyperX Cloud headsets are monstrously good value for money. So why did they need an update? Well, the original Clouds that Kingston developed were actually a design sold to the company by a Swedish manufacturer called QPAD.

The Revolvers are HyperX's (now separate from Kingston) first unique iteration of the Cloud headset. These babies are still everything we loved, yet in a new design, with a few extra tweaks under the hood to ensure we get the best possible sound.

The intuitive headband relieves pressure from the top of the head, and requires absolutely minimal adjustment to get it to sit just right. Despite their outward appearance, the Revolvers are actually open-backed. This opens up the air around the drivers, providing a better sound for the listener. You also get an impeccably good removable microphone.

The Revolvers have an incredible range. The upper heights of the treble are immense. At times, they sounded as crisp as the DT1770s, but the bass was just a touch more powerful. Unfortunately, this did impact the mids.

Compared to the old Clouds, we didn't prefer one to the other. They both sounded and felt excellent. Aesthetically, the old-school Clouds have far more class – they're sharp, smooth and elegant. The Revolvers have got that gaming flair.

Ultimately, the Revolver and Cloud II could trade blows with each other all day. It's a battle of the ages, but if you're after a sound gaming headset, you can't go wrong with either of these offerings. ■ Zak Storey

Verdict

Great soundscape; not typical gaming headset; comfortable; holds its own; removable mic.





GAMING MONITOR

\$999 | WWW.ACER.COM/AU

Acer Predator XB271HU

A stunning high-framerate gaming monitor, but it isn't the only option.

We're getting mighty close to the perfect monitor. The Acer Predator XB271HU is a gorgeous display, and ticks almost all the boxes. But, sadly, it's turned up to the party the wrong side of fashionably late, and wearing the same outfit as the host.

Acer has got so much right with the new Predator; it's rocking a high-end GPU-pleasing 2,560 x 1,440 native resolution, laid out on a 27-inch IPS panel. It comes sporting Nvidia's G-Sync frame synchronisation tech and is capable of hitting a top refresh rate of a 165Hz. The beefy GPU brigade may be hankering for a 4K IPS panel in there, like the ASUS RoG Swift 27AQ, but we're still some way off getting one running at those refresh speeds.

The 27-inch screen is the perfect scale, in terms of pixel pitch, for a 1440p resolution – and with a decent GPU, you'll be

running games at the native res of the panel at speeds that will make G-Sync look its best. Though that 165Hz refresh rate is a thing to behold. Don't get us wrong – 144Hz monitors still look great, but you can see a boost in visual clarity when things are shifting around the screen. Running two identical panels side by side, one at 144Hz and the other at 165Hz, you can easily see the difference.

It's those two identical panels that are the problem for Acer, though. ASUS beat Acer to the punch when it released the RoG Swift PG279Q earlier this year – that monitor runs the same AU Optronics AHVA panel as the Predator. So ASUS has stolen some of Acer's thunder by releasing its own 165Hz IPS beast, and that meant that, when we turned on the Predator, we were impressed that it looked pretty much just as good, but not blown away. To find a place for it, Acer has sanded off the corners, which

means it can offer the Predator for around \$100 less than the RoG Swift. As a result, it doesn't look as good; the slightly weird, aggressively angular feet are a little off-putting, the controls are rather basic and unintuitive, and the screen has that faux bezel-less look, where it's recessed to the same level as the panel. We much prefer the slimline bezel of the Swift. More importantly, though, we also prefer the visuals of the ASUS screen.

They're rocking identical panels; how could we prefer one over the other? AUO only delivers the panel itself to Acer and ASUS; the extra electronics and calibration are polished off at the manufacturer level, and no matter what we tried with those awkward controls, we couldn't get the Predator to look quite as good as the Swift. But therein lies the rub; our preference for the ASUS is born from testing the two cheek-by-jowl – most people are unlikely to

sit these two stunning monitors together. Everyone else is just going to be too busy falling in love with the incredible clarity, colour reproduction and impressively accurate blacks they both produce. We doubt anyone gaming on their Predator will shed any salty eye-juice over their experience.

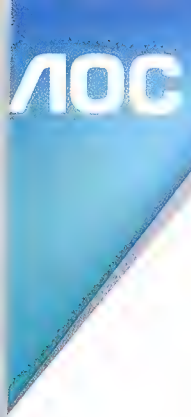
When it comes down to it, the ASUS RoG Swift PG279Q is the better all-round monitor. But the extra savings you get with the still-lovely Predator makes the decision between the two one born of cost above anything else. ■ Dave James

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

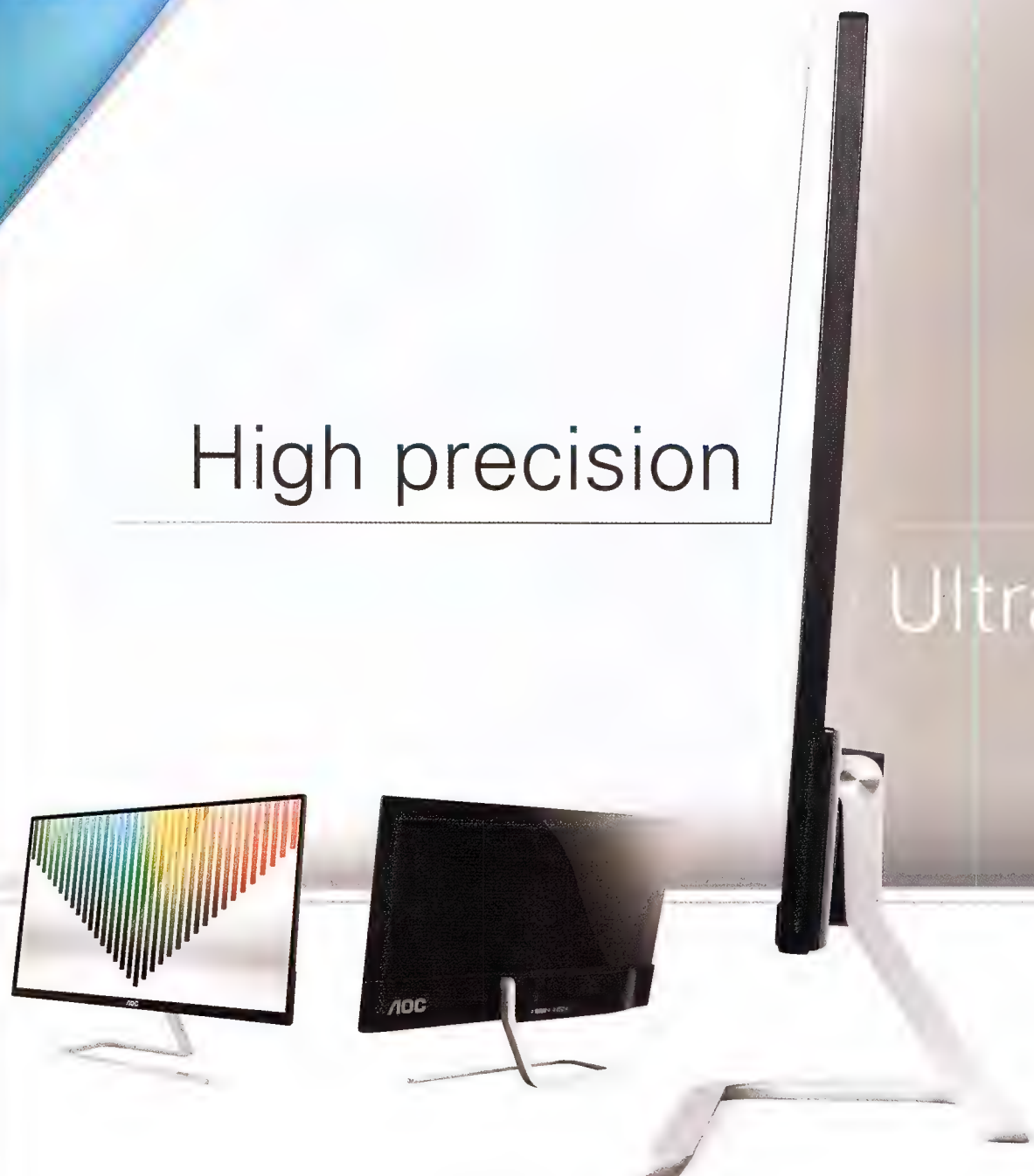
Great image quality; slick refresh rate; reasonable price.





High precision

Ultra slim

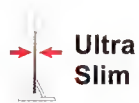


81-F IPS Monitor

Flicker Free, IPS Technology
and Infinity Glass Design

Specifications

Models	I2481FXH	I2781FH
Panel size	23.8"	27"
Screen Ratio	16:9	16:9
Response Time	5ms	5ms
Resolution	1920x1080	1920x1080
Input Signal	Analog & HDMI*2	Analog & HDMI*2





Logitech G610 Orion

Logitech is back on the menu, boys.

Honesty is generally the best policy, so even though it might sting to hear the truth, here it is. It's been a long (long) time since I've loved anything that came out of the Logitech stables.

The sharp, angular designs, superfluous 'G' keys and Romer-G switches just never hit the mark and screamed of a desperate attempt to stay relevant. Until now. This gorgeously utilitarian brick of Cherry-Brown encrusted plastic is a sheer delight – in both form and function. For an extended keyboard, its 445mm x 153mm size still feels nice and compact on the desk. The ubiquitous keyboard raisers on the bottom have been cleverly redesigned to include a midway height, now allowing you to choose from sitting flat on the desk, or at 4° or 8° angles. The Cherry Brown switches in our test unit are a the perfect type for anyone with noise concerns, plus their tactile

pushback feels just as nice to type with for anyone using their rig for non-gaming related tasks. The super-long volume scroller and oversized circular media controls are reminiscent of Corsair's flagship K-range – in other words, they're perfectly functional and usable without needing to look or fumble. You'll need to download Logitech's Gaming Software to get the most out of the G610's extended options, which include profiling for specific games, lighting options and per-key macroing. With a couple of tweaks and additions – a removable cable, cable routing on the underside and a USB port or two – in it's next revision, the G610 could become the perfect 'board.

■ Troy Coleman

Verdict

A refreshing change from Logitech's typical style and a great all-rounder gaming keyboard.



Roccat Ryos MK FX

Mechanical gaming keyboard with per-key RGB illumination.

Weighing in at a hefty 1.6kg and 44mm thick, Roccat's new keyboard is undeniably a beast. The FX includes ports for both headphones and microphone in the top left-hand corner, but the USB ports that resided on the right in the MK Pro (which we reviewed way back in APC February 2014, p.28) are gone. It rests on five smooth, high-grip pads that should hold it steady on your desk in the heat of any battle. It's also fingerprint resistant.

Down the left is a bank of macro keys, as well as three additional 'thumbsters' beneath the spacebar. Roccat has emphasised that the MX's lit keys can be customised per-key. You can create almost any configuration of colours you desire. This feature's main purpose, however, is really to highlight key bindings, modifier keys, macro sequences, system controls... whatever function you like. This board is not all about

the looks, though. Roccat's Easy-Shift[+] technology allows you to program a secondary function to each key. The keyboard supports N-key rollover and the keys on our unit came with Cherry Brown switches, which we found surprisingly noisy for brown keys – the spacebar in particular.

Typing this review on the FX was not an overly unpleasant experience, but this is, of course, a gaming keyboard and extended typing of prose isn't its main purpose. There's no denying that there's something quite striking about this monster. It's a well-made piece of hardware that deserves to be in a hardcore gamer's arsenal if they want just that little hint of style.

■ Carmel Sealey

Verdict

Extensive lighting and key function customisation make this a stylish gaming peripheral.





Razer BlackWidow X Chroma

Comes in any colour you like.

Razer continues its campaign to confuse the hell out of anyone looking for a keyboard, with the BlackWidow X Chroma joining the likes of the Deathstalker Expert, Deathstalker Chroma Membrane, BlackWidow Tournament Edition Essential, BlackWidow Tournament Edition Chroma, BlackWidow Ultimate Stealth and more.

The Chroma has a multicoloured lighting mode – a system that lights keys as you press them, and leaves them lit for a few seconds, before gracefully fading them out, with 16.8 million colours to choose from. The light passes through the letter cutouts on top of the keys, rather than spilling out around the sides, and we prefer it this way. All the lighting effects are controlled from the bundled Synapse software, which is simple to use.

The Chroma comes with Razer's own switches or the Cherry MX Blues. The height of the keys will come

as a surprise to anyone used to a standard membrane keyboard, and we found it tiring to type on for long periods. But this keyboard is built with gamers in mind, rather than typists. Holding your hand on WASD is comfortable, though you may want to add your own wrist rest. The small feet at the back are capable of altering the angle, but only in one position. The Chroma lacks any macro keys and the metal of the keyboard's frame is exposed, with no plastic cover.

In a world where more is often looked upon as being, well, more, we applaud this smaller keyboard, with its simplicity. It's only \$20 cheaper than its bigger brother, but do you really need those macro keys?

■ Ian Evenden

Verdict

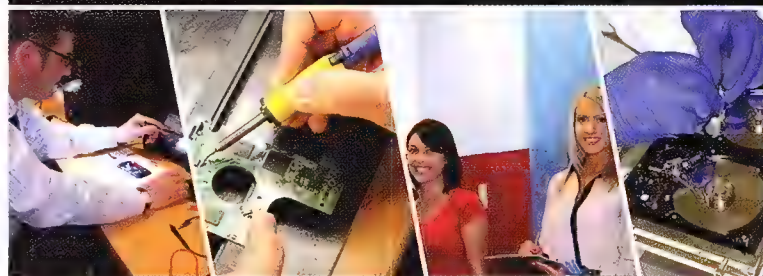
Streamlined design; useful lighting mode; good feel to the keys.



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SMARTPHONE

FROM \$1,099 (32GB) | WWW.HTC.COM

HTC 10

Not quite a 10, but pretty darn close.

Only time will tell whether HTC can clamber back to the top of the Android smartphone heap, but one thing's certain: with its new flagship, it's certainly giving it a try. The 10 maintains its predecessors' highlights, including a clean and stylish metal unibody case and HTC's speedy and slick Sense UI, but makes the physical design a bit cleaner and adds features that match or beat its competitors in almost every area.

It's certainly not wanting for specs, with the fastest ARM CPU/GPU combo currently on offer – Qualcomm's Snapdragon 820 and Adreno 530 – 4GB of RAM, 32GB of onboard storage and a 5.2-inch IPS display at 1440p. HTC's moved the main Android Back, Home and App Switching buttons off the screen, meaning that, unlike the One M9, apps and games get to use the whole thing. That Home button doubles as a touch-sensitive and

super-speedy fingerprint sensor; place a registered digit over it and it both wakes-up and unlocks your phone. HTC's BoomSound speakers are the best external ones you'll get in a smartphone – although we'd still take headphones for listening to music.

HTC's stripped out a bunch of redundant apps – it's no longer bundling its own apps when it thinks Google's will do fine, saving storage space and reducing app clutter.

The 10 isn't perfect, however. When its processor gets going, the whole back gets a bit warm, and the S7's AMOLED display is more vibrant than the 10's LCD.

The HTC 10 does have some advantages, but not quite enough to beat the Galaxy S7. **■ Dan Gardiner**

Verdict

A great smartphone that's only undermined by just how strong the competition is.



SMARTPHONE

\$679 | WWW.APPLE.COM/AU

Apple iPhone SE

Apple has gone back in time with its iPhone SE, but it's more than just a retro device.

Apple knows there are customers out there who don't want a huge phone. That fact was the impetus for the launch of the iPhone SE – a 4-incher that looks like the long-lost twin of the iPhone 5, but with iPhone 6S guts inside.

From the outside, the SE is almost indistinguishable from its three-year-old doppelganger. But from inside the phone, things are different. Apple has delivered a wide range of upgrades across the board, turning the SE into a powerful handset.

The most notable improvement is the camera. The 5S packed an 8MP sensor with True-Tone flash, but Apple has managed to upgrade the SE to include the same 12MP camera as the 6S. That includes 4K video recording and Apple's proprietary Live Photo functions as well.

The SE runs on the same A9 processor as the 6S, so it's no slouch when it comes to running the latest 3D games

and demanding multimedia. The battery capacity has been given an ever-so-slight boost over the 5S, but with improvements in efficiency thanks to better software and the newer A9 chip, the battery will get you through the day comfortably.

The real selling point for is the price – at \$679 for the 16GB version, it's the cheapest iPhone Apple has launched. Admittedly, it's still a long way from headlining the budget category, with competent Androids on offer for around half that.

But for any hardcore Apple fans still using an iPhone 5S or earlier device because they prefer the size, it provides an attractive upgrade.

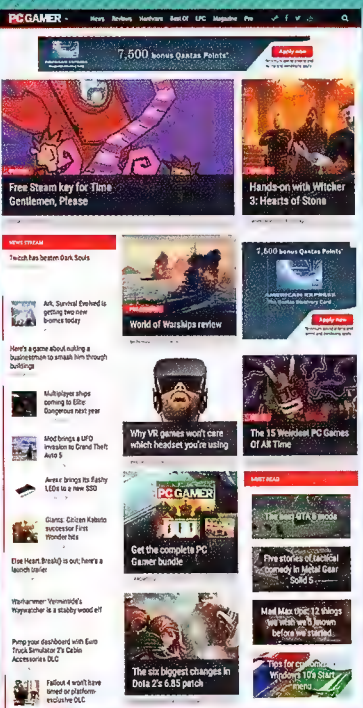
■ Nick Broughall

Verdict

A great option for those who prefer the smaller phone but with the grunt of a larger one.



SMARTER COOKIES ENABLED



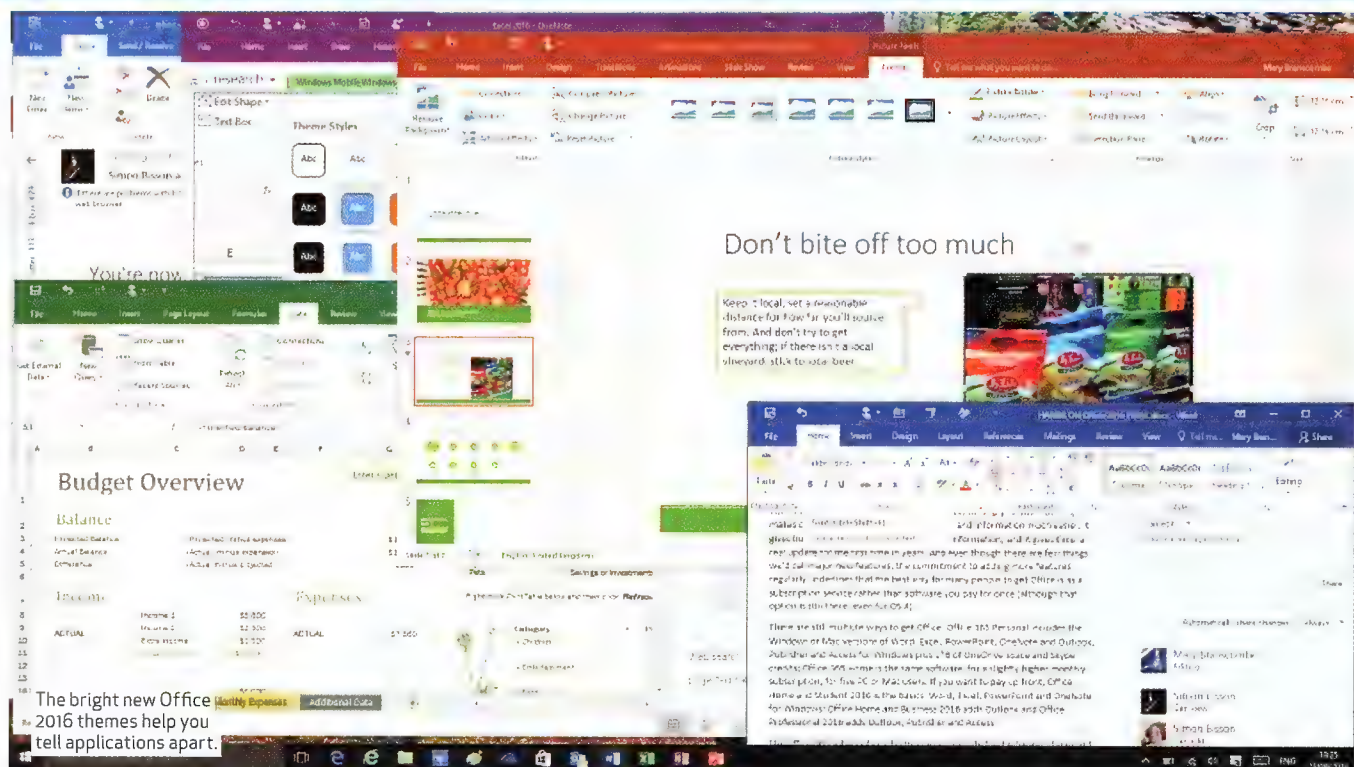
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Windows SOFTWARE



Microsoft Office 2016

Six months in, the latest refresh of Office is colourful, intelligent, intuitive and cross-platform... but is it worth upgrading to? Mary Branscombe finds out.

At this point, the question for Office on Windows isn't so much how much more can you do with it, but rather how can you be more effective and more productive with Office. That's the direction we're seeing Office 2016 go in.

This new release has a new look and fresh tools to help you find features, it makes collaborating and sharing documents and information much easier, it gives businesses more options for securing information, and it gives Excel a real update for the first time in years.

And even though there are few things we'd call major new features, the commitment to adding more features regularly underlines that the best way for many people to get the Office suite is as a subscription service (via Office 365) rather than software you pay

for once – although that option is still there.

THE UNIVERSAL LOOK

Microsoft is calling Office 2016 more colourful, with new design themes that make it abundantly clear which Office app you're in (blue for Word, green for Excel etc), but we'd call it the slightest bit more chunky as well. While there's a compact view designed for mouse users that takes up about a millimetre more space than the big and finger-friendly touch mode in Office 2013, and the 2016 touch mode ribbon and toolbar take up another couple of millimetres, eating away at the space you have for documents.

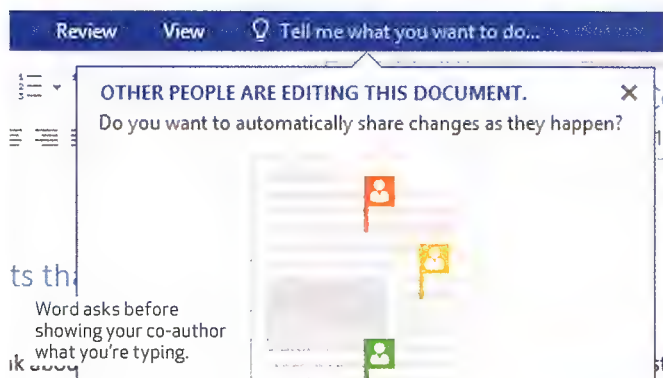
For files you save to OneDrive or OneDrive for Business, the list of recent files in each application is at least more useful. It's now grouped and labelled:

any files you've pinned are always there in the Pinned group, but the others are grouped under Today, Yesterday, This Week, Last Week and Older, which can speed up finding what you need. Documents you won't open again can be removed, and you can copy the details of where the file is; just right-click.

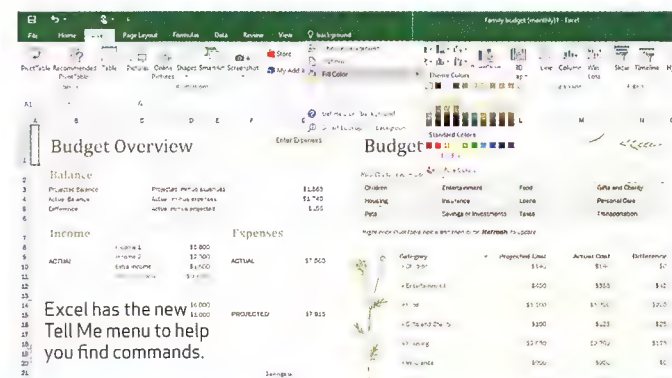
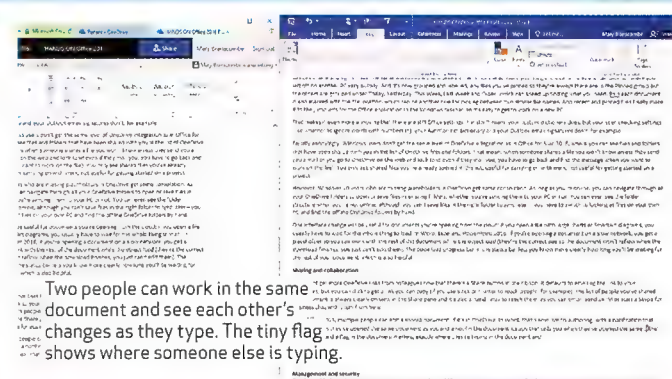
It's annoying that there are still some Office settings that don't roam, however. Your custom dictionary does, but your spell checking settings (like whether to ignore words with numbers in), your AutoCorrect dictionary and your Outlook email signatures don't, for example.

WORD IS FOR CO-WORKING

As in Office 2013, multiple people can edit a shared document, if it's in OneDrive. You might get more OneDrive links from colleagues now



And it's not as fluid as Google Docs implementation. If one person is editing a paragraph, for example, no-one else can change it. You can also right-click on a paragraph and choose 'Block Authors' to stop anyone else editing it altogether, even if you're working elsewhere in the document, and that's permanently marked so other people



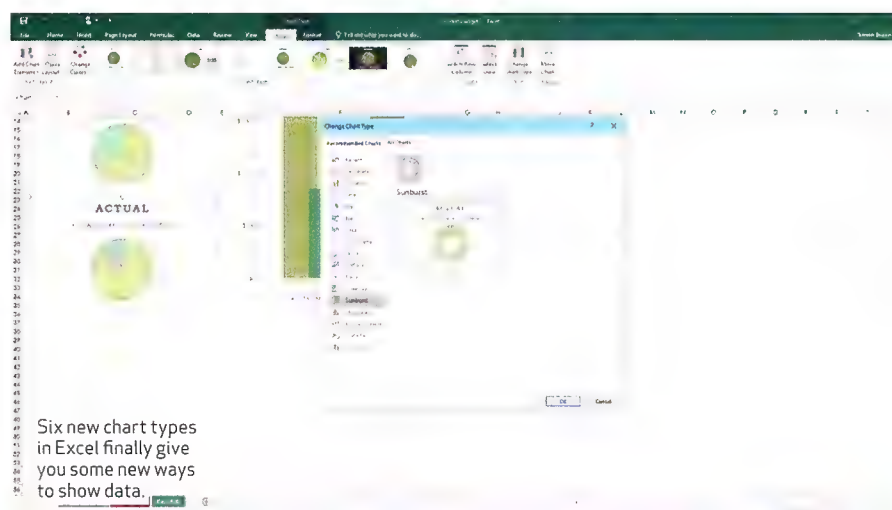
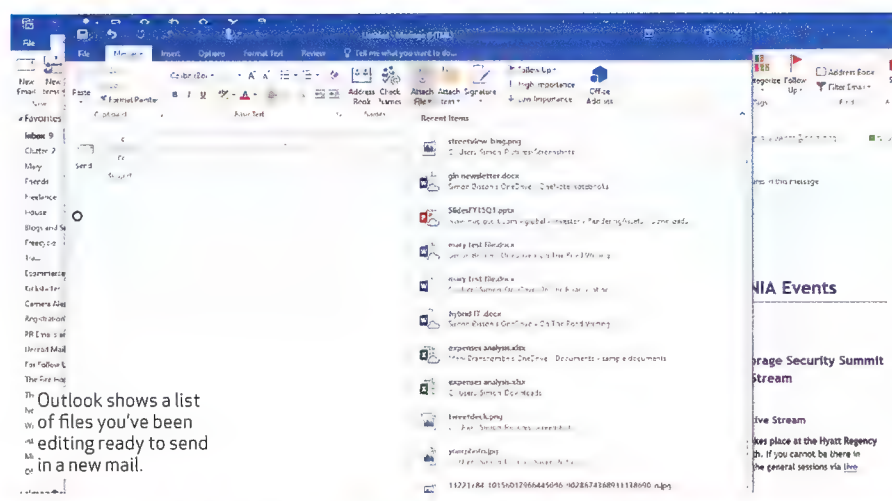
"It's not flawless, though; we did see some glitches, where words the other person typed appeared in the wrong place."

Microsoft plans to add live co-authoring to other Office programs in time, but at present, it's in Word only — admittedly the most logical place to have it.

In all the Office programs except OneNote and Publisher, the ribbon also includes the new Tell Me feature, which aims to make finding specific tools and functions easier. Tell Me gives you a search box where you can type what you want to do (adjust line spacing, print and so on) and get a mini-menu of tools that match what you're asking. It's actually quite smart about working out what you're looking for, so you don't have to type the exact name of the command.

Word, PowerPoint, Outlook and Excel have another tool for looking up information and, like Tell Me, it's borrowed from the Office online apps. You can select a word and choose 'Smart Lookup' from the context menu to get a pane of search results, images, Wikipedia info and dictionary definitions. This is a much more useful version of the 'Define' and 'Search with Bing' commands that it replaces, because you get all the information in the same place – previously, you could see the dictionary definition inside your document but the search results opened in your browser.

Along with the standard new Office 2016 features, Outlook 2016 gets one superbly useful new feature – the list of recent files that pops up when you



"We also like the responsive design that fits Outlook into smaller windows better."

click to add an attachment. After all, the file you're most likely to want to send to someone is probably the one you've just been working on.

This might get confusing, though — if the file is on OneDrive, Outlook assumes you only want to send a link to it rather than the actual file, so the recipient has to be online to download the file itself. You can select the attachment and change that each time, but you have to remember to do that.

We also like the responsive design that fits Outlook into smaller windows better. Instead of shrinking down all the panes you have displayed so you can't really see any of them, Outlook automatically switches to showing just the inbox list or just the message pane as you resize the window, depending on what you have selected. That works especially well on smaller tablets.

Also useful on smaller tablets is the option to save less of your inbox on the device. In Outlook 2013, the default is to download the last month's worth of email and you can't choose anything

less than that. In Outlook 2016, you can keep two weeks, one week or just three days of messages to save space.

EXCELLING IN EXCEL

Excel 2016 gets the widest range of new features in Office 2016 — as well as all of the new interface features, Excel does some long overdue catching up. Some of that's the six new chart types — including treemaps, sunbursts and the waterfall chart for showing how positive and negative figures match up.

There's a new forecasting option that makes it easier to create forecasts that aren't just linear; you can choose the confidence level you want to see, or put multiple forecasts in the graph. And there are also little things like photos getting the correct orientation when you insert them.

Excel 2016 finally makes more sense of Microsoft's business intelligence and data analysis options. In the past, these were only in the Pro versions of Office, but they were also complex and didn't integrate well. Now you get at least the

basics, even in the Home version of Excel 2016, although the business versions can connect to a lot more data sources, and more of the tools are built in.

Excel also does much more of the work for you, offering to automatically build relationships between multiple tables, and automatically finding times and dates and using them to group the data. This rationalisation of the Excel data analysis tools makes a lot more sense than the grab bag of add-ons for previous versions, and it's a good sign for the future of the program.

APPS WITH FEWER CHANGES

The new version of PowerPoint finally gets an easy way to compare the changes that other people have made to a shared presentation — you can see the slides side-by-side and pick which changes to save. Other than the screen recording tool that Office 365 users got as an update for PowerPoint 2013, however, that's the only new feature in PowerPoint, though it does get Tell Me, Smart Lookup, the new sharing features, ink equations, and all six of the new Excel chart types.

Access and Project have also seen a set of small but useful changes, but OneNote and Publisher essentially get nothing but the new Office themes and the colourful title bar.

THE FINAL VERDICT

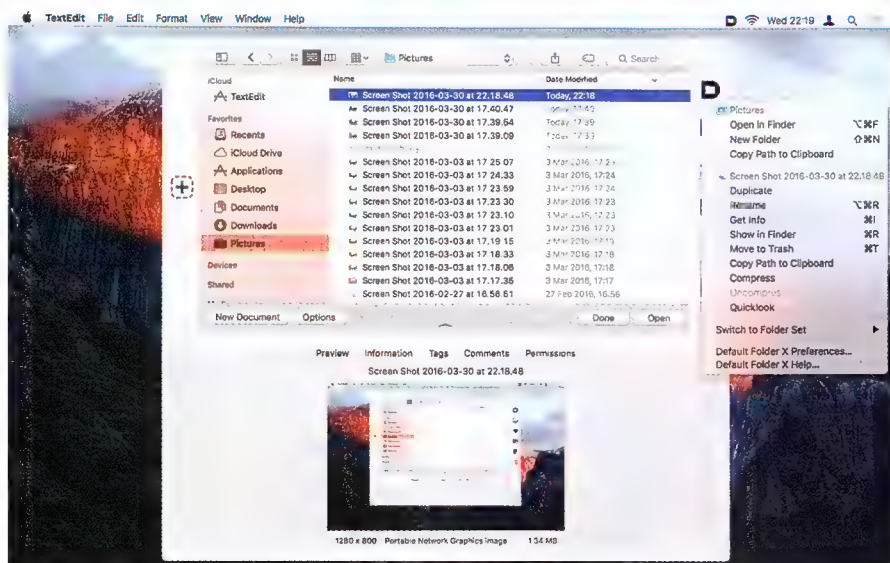
What's perhaps the most surprising thing about Office 2016 is that there are few real improvements for touch users — just the context-sensitive touch shortcuts in Outlook, the multi-select mode for PivotTables in Excel, and being able to write maths equations with your finger, or a pen, and have them converted to text, in PowerPoint, Word and Excel. That's pretty limited with the rise of 2-in-1s (and when so many notebooks have touchscreens), but if you want to get away from the mouse and keyboard, Microsoft expects you to use the far less powerful Office Mobile apps.

You might pay for a new version of Outlook just to make it faster to attach recent files to an email, because while it's a tiny feature, it's enormously useful and saves so much time. But you probably wouldn't buy a new version of Word just to get live co-authoring or the Smart Lookup feature. That matters much less if you're buying Office as a subscription that gets you new features without paying any extra, making modest improvements in Office useful to a lot of people very quickly.

If Microsoft can keep up the pace of bringing out new features for the Office programs the way it does for the Office 365 services, Office can keep getting more useful features without complaints about the price tag. ■



Mac » APPS



Default Folder X 5

Power up Mac file management.

US\$34.95; UPGRADE FROM V4, US\$14.95 | STCLAIRSOFT.COM

D Apple's drive towards minimalism can prove frustrating in Open and Save dialogs, which have barely changed as OS X has evolved. Aside from some stashed favourites and a handful of recent places in a pop-up menu, they do little to speed up your workflow. By contrast, Default Folder X is chock-full of features that power up these dialogs in a major way and boost other key areas of OS X.

The first time you use Default Folder X, its presence is felt. It surrounds the Open and Save dialogs, adding several new menus. These house all manner of commands, including the means to change a selected item (rename, duplicate, compress, etc), and access to recent files, folders and open Finder windows and tabs. A less obvious but hugely useful transformation is the switching of the menu for one that lets you browse the entire file system at speed. This menu is optionally mirrored in the menu bar and Finder's toolbar, and there are other goodies lurking outside of Open and Save dialogs.

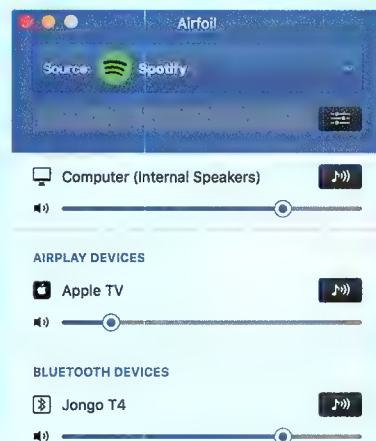
Folder X's extensive preferences enable you to define keyboard shortcuts for menu commands and favourite folders. You can also create folder sets (e.g. to have unique folder shortcuts for individual projects), which can be selected from the

aforementioned menus. In addition, default folders can be defined for individual apps, and limited to a specific extension. So if you usually save TIFFs in one place but JPEGs in another when working in an image editor, you can configure the app to automatically go to the correct initial location to open or save a file according to its type.

However, Folder X sometimes feels sluggish. It's noticeably slow to appear when activated and lags a touch when shortcuts are invoked. We also found the new features hit and miss. It's great to have a recent files list and fast access to Finder tabs, but the new sidebar for stashing documents seems superfluous. Also, while we appreciate the app adding a tagging system for files and folders, we didn't use it much after our initial curiosity wore off.

There's also an ongoing nagging feeling that Default Folder X can be initially baffling and overwhelming — something that new features and added complexity fail to dispel. Still, as ever, it remains an app that rewards investment. Spend some time learning the ropes and setting things up, and you'll gain many more savings in the long run. Chances are, Default Folder X will become one of those apps your Mac feels naked without.

Craig Grannell



Airfoil 5

US\$29 | ROGUEAMOEBA.COM



Airfoil has been a popular audio utility for many years, and it's still adding new features that makes it a useful tool for people who need precise control over their Mac's audio output.

This new version adds the ability to stream to Bluetooth speakers in addition to AirPlay speakers and devices such as the Apple TV (which was already supported). Of course, Bluetooth is already built in to your Mac, but Airfoil gives you more control by allowing you to select just one specific app — such as iTunes or Spotify — as the audio source.

Any other audio played on your Mac, such as ABC iView running in your browser, will then continue to be played on your Mac's internal speakers. This will be useful if you want to stream music to another room while using your Mac or if, like us, you like to listen to music on Bluetooth speakers while hearing a game's sound effects coming from your Mac, or if you've been sent a video link and you don't want to stop your tunes on your Bluetooth speakers in order to watch it.

You can also create a multiroom audio system by sending your audio source to multiple speakers, and Airfoil includes a free app called Satellite that streams audio to other Macs, iOS devices and even Windows PCs.

Airfoil isn't too expensive, and there's a trial version that streams music for 10 minutes at a time to give you a taste of its capabilities before you buy. **Cliff Joseph**

App Store » iOS APPS



Dripler

Tips, apps and updates.

FREE | DRIPPLER.COM



Dripler is a free service designed to help you discover new features for your iOS or Android device. Find out about the latest software updates and upgrades, secrets, tools, widgets and tips, as well as tech news and app reviews from worldwide web sources, all routed into one app.

My Drips is your portal to all of this, allowing you to sort your list by News & Tips, Apps or Games, or by date or popularity. However, while it might just be a bug on the iPhone version, using the Sort By option comes up with the same stories each time, regardless of what you pick, making this feature a bit meaningless. Hopefully, this is something the developers are aware of and are fixing.

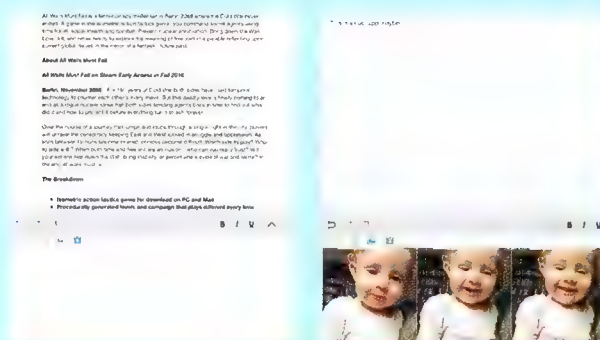
Dripler hosts articles that can help you extend your phone's battery life or speed, backup your files, help you master photo-taking, free up space, customise your display... just about anything. A neat addition is the occasional list of apps on sale or for free. All articles are available to bookmark and 'like', as well as to share on social media. The interface is fairly user-friendly, though the option to see a simplified list of article titles to save you scrolling so much wouldn't go amiss. **Carmel Sealey**

ThingThing

FREE | THINGTHING.CO



This is a keyboard revamp that works on a system level, adding access to a bunch of features that you'd otherwise need to multitask across apps for. For example, while typing an email, you can immediately add details from your calendar or photo library, but more advanced functionality includes connectivity with Dropbox, Google Drive, Instagram, Flickr and more. The best thing about Thingthing is that, while it adds a bunch of handy features, it doesn't impede the overall user experience of the vanilla Apple keyboard (we tested on an iPad). If you're a busy person who communicates predominantly via email, ping and shooting zips and spreadsheets to all and sundry, then this app should suffice. Best of all, there's not really a learning curve to speak of: choosing components to add to an email is as simple as tapping a small menu box on the keyboard and then selecting the relevant file or item from inside the app. **Shaun Prescott**



CornerTube

\$4.49 | CORNERTUBE.TINYWHALE.NET



One of the best features of iOS 9 is the ability to play videos in a floating, scalable window while you use other apps. Called picture-in-picture, it's great for those apps that support it — by default, that's FaceTime and anything that uses the standard iOS movie player. YouTube, though, doesn't, so you can't watch YouTube movies using the feature. CornerTube solves this, and though it's not always a frictionless experience, that's usually the fault of how other apps expose their links. You can search the YouTube catalogue from inside the app, but you'd more usually copy a link and then launch CornerTube from its Today widget, or send a YouTube link to CornerTube using an action in the standard share sheet. And these work, though anything an app does to mask a YouTube link (such as wrapping it in a t.co short URL on Twitter) can stop it being recognised. It's not always smooth, but it still does what it promises. If you need the feature rarely, you could wait and hope Google adds it to its YouTube app, but \$4.49 isn't much to ask if you're likely to use it lots. **Christopher Phin**



Google Play » ANDROID

Reddit: The Official App

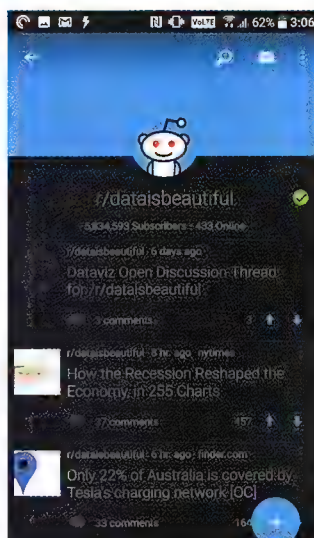
The crowd-sourced news site's first app may leave you a bit nonplussed.

FREE | WWW.REDDIT.COM/R/REDDITMOBILE



Reddit's first official Android app (and also available on iOS) covers all the essentials you'd expect: you can view front-page posts, sign into a Reddit account, upvote and downvote posts and comments, browse subreddits and even post new content.

There's the all-important night mode (browsing Reddit in bed seems to be a popular past-time), thumbnails for images, and it'll blur out NSFW content so you can use the app in public places. In this early state, it's basic but functional. What's missing are advanced features like automatic marking of posts as read, integrated image, GIF and video viewing and the interface, in general, could be a little more streamlined — it can require excessive tapping at present. This will suit new or casual Reddit users, but until it adds more features and polish, we reckon seasoned veterans will be better-served with Relay, BaconReader or the appropriately-named 'reddit is fun'. Dan Gardiner

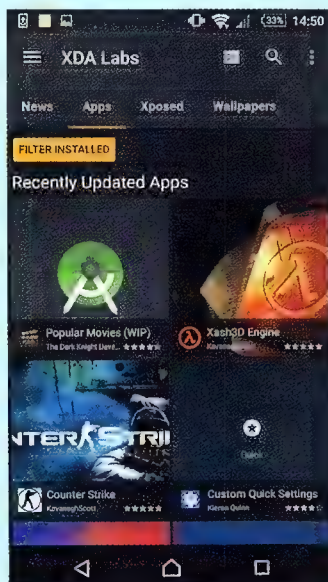


XDA Labs

FREE | WWW.XDA-DEVELOPERS.COM/XDA-LABS



Google's Play Store is full of useful apps, though it does stay within the boundaries of the Android ecosystem. For something a little more custom, the XDA Labs app allows you to dabble with the cutting-edge of apps cooked up by enthusiast devs. It's provided by the boffins at the XDA Forums, an oft-impenetrable source of Android coding and customisation, though the app itself makes browsing the community's creations much more user friendly. Here, you can grab apps, ROMs, customisation tools and more, though to get the most out of it you'll need a rooted device. Be warned, this isn't for the faint of heart, but venture bravely and you can get Half-Life running on your Android (easy), turn off Google Play Games notifications (sneaky) or change the serial number of your device (somewhat in a grey area). The app also acts as a news hub from the forums if you're a budding dev (or seasoned twacker) and want to stay informed. Paul Taylor

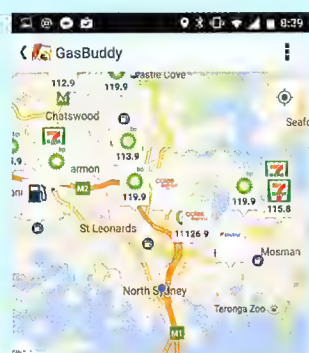
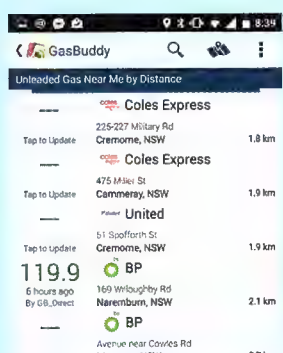


GasBuddy

FREE | WWW.GASBUDDY.COM



Among the largest concerns to humankind — next to impending climate apocalypse and geopolitical turmoil — is where to get petrol cheapest. GasBuddy is an app that can help with that: it lists all nearby petrol stations according to your location, along with the last reported cost per litre. You can filter per petrol type (Unleaded, Diesel, E10 etc), and it works with Google Maps too, so you can get directions to the nearest and cheapest outlet. The ad-supported app is also largely driven by its community, with users able to report petrol prices for particular outlets in order to earn points. In fact, the whole app is amusingly gamified, with the presence of challenges for those who find their calling in the fuel price reconnaissance trade. Enough points and you might be entitled to free fuel, which is a tantalising prospect: get free fuel for looking for cheap fuel while helping other people get cheap fuel. What a glorious future we live in. Shaun Prescott



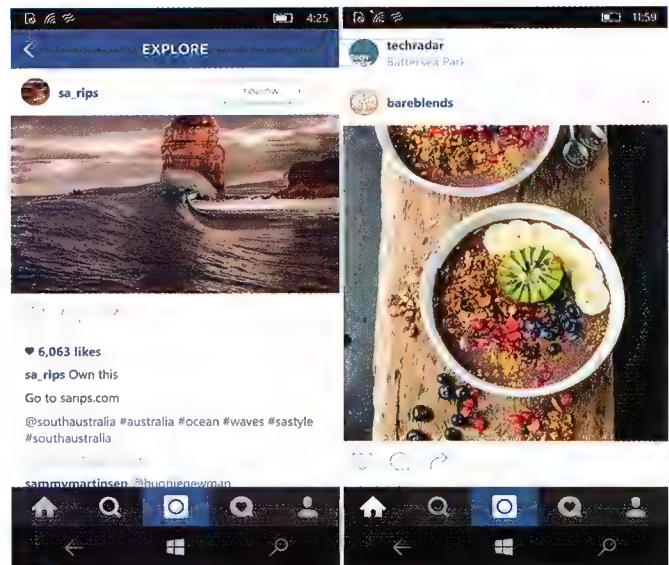
Windows Store » WIN PHONE 8

Instagram

A win for Windows phones.

FREE | [TINYURL.COM/APC429-INSTA](http://tinyurl.com/APC429-INSTA)

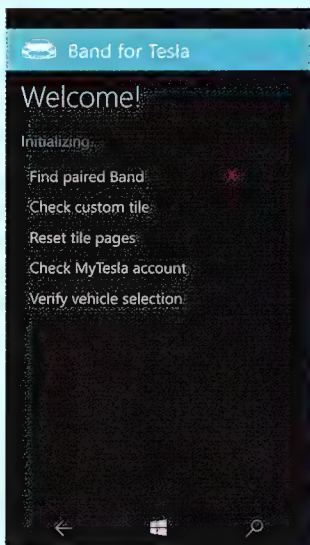
 Instagram officially launched an app for Windows mobiles way back in 2013, but it's basically languished in beta form ever since. In a surprise turnaround at the end of April, however, Microsoft mobiles have finally received a proper version. Considering that beta version had no video support and that users would have to turn to third-party apps (like the previously reviewed 6tag), we wouldn't be surprised if most Windows-phone owners had actually given up on being able to use the popular photography-oriented social network. This new upgrade is a fairly worthy one, bringing with it a prioritised feed, direct messaging, an 'explore' section and video features – that puts it in line with the current Android and iOS offerings. In addition to that, the app's washed its home tile with the pale blue colouring that is common across Windows 10 and there are a number of reported bug fixes and general stability improvements. Considering Facebook is seeing a continual decline in the autobiographical posts of users, it might be hoping that Instagram (which the social giant owns) can pick up some of that slack. Joel Burgess



Band for Tesla

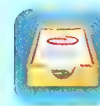
FREE | [TINYURL.COM/APC429-TESLA](http://tinyurl.com/APC429-TESLA)

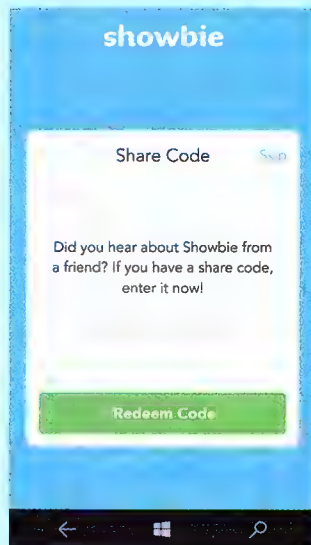
 The chances of you having a phone running Windows 10 plus a Microsoft Band in addition to one of Tesla's pricy Model S electric cars are pretty slim. If by some miracle you actually have all of these, then the Band for Tesla Model S app has been specifically designed for you. After signing in, the app will add a new Tesla tile to your Band's screen. As long as your phone and band are in Bluetooth range of each other, via the app, you'll be able to view the current car driving status, speed, location, compartment temperature, lock status and the battery percentage, plus an ETA on finish time if the car is currently charging. If that wasn't enough, you can also lock/unlock it, toggle air conditioning, honk, flash the headlights and start the car, too. Although it might not be an overly common combo to have, if you've got the funds for a Model S, chances are you'd fork out for a Microsoft Band and Windows phone just to have those perks on your wrist. Joel Burgess



Showbie

FREE | [WWW.SHOWBIE.COM](http://www.showbie.com)

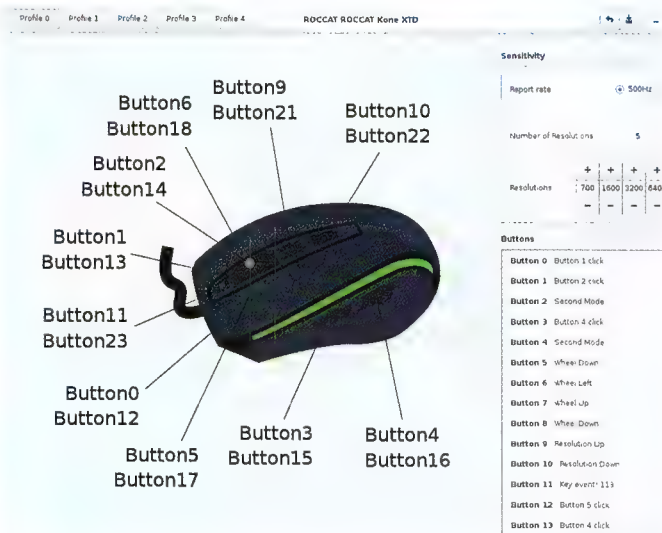
 If you're a teacher (or just a diligent student for that matter) and want to be able to easily give your class assignments without having to print them, then Showbie is an excellent app you can use to communicate directly with your class. You first access the app as a teacher, creating a classroom that will be assigned a specific code. You can then begin to populate the room with assignments. From here, students and parents can sign up and join the classroom by entering the code, letting everyone track what tasks are still outstanding and also submit completed files to the hub. With the paid versions, teachers can also upload grades for work and communicate directly with parents regarding their children's assignments. Because each classroom has an independent task list, students can sign up to multiple classes and have all their tasks in the one place. If you're a teacher who's looking for a resourceful way to get your students to do their assignments, Showbie seems to be an excellent solution. Joel Burgess



Piper

Adds easy control to gaming mice.

FREE | [BIT.LY/PIPERMOUSECONFIG](http://bit.ly/pipermouseconfig)



There are already quite a few hardware-specific Linux tools that provide extra features for certain peripherals. We especially love mice at APC, and here's Piper with a wider set of them. This time, we're taking a look at a Python-based GTK wrapper around the libratbag library in Linux. Despite the dissonant naming, both components offer great technology to configure feature-rich gaming mice.

Currently, Piper supports nearly 20 mice made by Etekcity, Logitech and Roccatt, but unfortunately not Razer (due to EULA restrictions on reverse engineering). Piper is a much-needed tool for Linux gamers who own advanced input devices with extra bells and whistles and want to use them.

Gamers and Linux geeks are entirely different target audiences and, in the past, not all gamers would want to play with the ratbagd daemon to set mouse buttons actions in command line, so Piper — a creation of Peter Hutterer from Red Hat — fills the gap perfectly.

Piper is a neat GTK3 application with a clear toolbar layout and helpful mouse annotation. The application shows the profile buttons along the top edge of the screen and a vertical side bar for binding buttons along the right edge. You use the buttons (with three dots) next to the desired mouse button to associate it with a certain action or command. You can also adjust mouse sensitivity settings, including report rate and resolutions. Any combination of settings can be stored in different profiles, so that you can use, for example, a gaming profile for playing in Steam and a more classic one for office work.

Currently, Piper is in the early stages of development, which is why there aren't so many builds for Linux distributions. You can find Piper packages in OpenSUSE OBS, as well as in Copr for Fedora. More builds may follow shortly.

Alexander Tolstoy

Pass

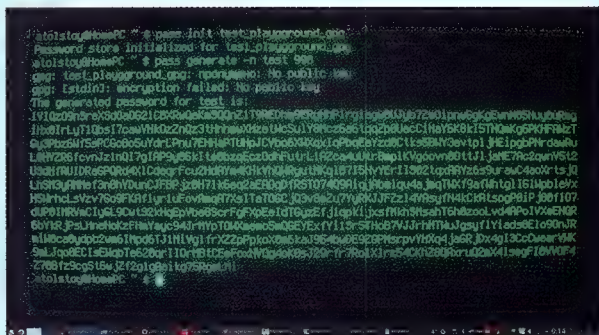
FREE | [WWW.PASSWORDSTORE.ORG](http://www.passwordstore.org)

Pass is a command-line password manager, where each password sits inside a GPG-encrypted file named after the website or resource that requires the password. These encrypted files can be organised into meaningful directory hierarchies and copied from computer to computer and, in general, manipulated using standard command-line file management utilities.

Pass makes managing individual password files extremely easy. All of the passwords live in `~/.password-store`, and Pass provides some nice commands for adding, editing, generating and retrieving passwords while being a very short and simple shell script. It's capable of temporarily putting passwords on your clipboard and tracking password changes using Git. The password store doesn't have any restrictions on what you can save and how you organise the data. It also includes Bash completion, password generation, Git support and the ability to import passwords.

Under the hood, Pass is just a Bash script (with a few Python and Ruby helpers), which makes it lightweight and easy to audit and add your own modifications.

Alexander Tolstoy



NTFS-3G

FREE | [BIT.LY/NTFS-3GDRIVER](http://bit.ly/ntfs-3gdriver)

The support for the NTFS filesystem in Linux has been experimental for many years, but it has recently got significantly better thanks to the NTFS-3G driver. This driver is complemented with a set of utility programs under the name of 'ntfsprogs'. Once you've got NTFS-3G on your system, you can access NTFS partitions transparently, by simply clicking on it in your file manager. The manual mounting, once you need it, should be done in a similar way to this: `$ mount -t ntfs3 /dev/sda1 /mnt/windows`

Even if an NTFS partition was left in the so-called 'inconsistent state', NTFS-3G will try to mount it in the recover mode, which is safe and shouldn't break anything.

The recent NTFS-3G update brings a more complete and stable NTFS support, which is already reported to work fine with Windows 10. NTFS-3G in Linux supports better handling of bad clusters, live data compression and rolling back Windows updates. If you work with Windows partitions from Linux, NTFS-3G will be a very welcome update.

Alexander Tolstoy

COMPLETE GUIDE:

SELL YOUR SPARE TECH



CLEAN-UP & RESET OLD DEVICES SO THEY'RE 100% SAFE FOR SALE + SELLING TIPS & TACTICS

FOR SALE

IF YOU'RE ANYTHING LIKE US, YOU'VE GOT A SLOWLY-GROWING COLLECTION OF OLD COMPUTING GEAR AND GADGETS IN YOUR HOME THAT YOU'RE NOT SURE WHAT TO DO WITH. [LINDSAY HANDMER](#) REVEALS YOUR BEST OPTIONS FOR SELLING OR DONATING IT — AND DOING IT SAFELY.

Buying a shiny new device can be oh so satisfying, but the never-ending upgrade cycle can get expensive. Selling your old devices is a great way to recoup some of your money, but it can be a surprisingly complex process. We've put together a comprehensive guide, showing you how to ensure your tech doesn't contain any personal information and where and how to actually sell it.

GETTING STARTED

These days, our phones and laptops are used to store and access so much sensitive personal data, it's vitally important to render them safe before selling. Even after performing a secure wipe, the actual process of selling tech can be very time consuming and open to potential scams. It's also worth considering other options, such as

repurposing old tech, donating it or simply recycling it. Having a solid handle on the selling process before buying new tech is also quite useful. For example, upgrading to the latest smartphone each year isn't as hard on the wallet, when you know what to expect from selling last year's model.

BACKUPS AND FINAL CHECKS

It should go without saying, but make sure to back up all your data before wiping or selling a device. Most smartphones and tablets have built-in backup options to the cloud, but it is always worth taking a manual copy of any photos and other files and storing it on a PC or NAS.

Double-check your apps and games — some software products are licenced to a specific computer or device, which can cause problems when selling. Most can be managed

online and the sold device deauthorised, but in some cases, you need to handle it before performing a reset. Don't forget to double-check mobile devices and laptops for any forgotten SD cards or simcards — this is an easy way for data or personal info to sneak through the wiping process.

For the extra security conscious, the tech selling process is a good time to consider your existing passwords and practices. If you have not already, enabling two-factor authentication on any accounts on the device means that, even if the worst happens and somehow a password can be recovered, your security won't be compromised.

OTHER TECH

While we have focused on computers and mobile devices, some other tech



WIPE YOUR CONSOLE, TOO.

Going beyond phone and laptops, other devices such as gaming consoles can hold information such as credit card details, or account access to services like Netflix.

DON'T FORGET THE SD CARDS!

Forgotten SD cards are an easy way to leak personal information — and a normal in-device format is not enough to securely erase them.



can still hold data and information that should be removed. Items such as MP3 players, consoles and eBook readers are linked to your accounts, and can have access to saved credit card information and private Wi-Fi networks. Not all devices can be factory reset, or run other secure erasing apps. Always make sure to log out of any account and have devices forget any stored Wi-Fi passwords. That old media player might net a little extra cash when sold, but forgetting to remove your Netflix login could give the buyer access to your account. Even when formatted or erased with in-device controls (for example, in cameras), SD cards can contain recoverable data, such as pictures. Worse, they can often contain metadata, such as GPS coordinates that can reveal information you might not have even thought of.

HOW TO FACTORY RESET YOUR DEVICES

THE FIRST STEP IN SELLING OLD GEAR IS TO MAKE SURE IT'S NOT A THREAT TO YOUR SECURITY.

Most fairly recent tech has a range of built-in options to restore it back to factory settings. This removes any apps, personal data, passwords and linked accounts. In most cases, this process makes it safe to sell or otherwise dispose of any tech without worrying that any of your data can be recovered. It's worth repeating, though — make sure everything is backed up. For battery devices, make sure you plug in the power adaptor before getting started, to avoid running out of juice mid-process.

WINDOWS

Both Windows 8 and 10 have built-in options to perform a factory reset of your PC or laptop. The simplest way to find the option is to type "reset" into the search bar. Otherwise, head to 'Updates and Security Settings', then 'Recovery'. There are two options provided — select 'Remove Everything'. This securely wipes everything on your PC and returns it to factory settings, whereas the 'Keep My Files' option does not delete any personal data. Older versions of Windows (including 7) don't have a factory reset option, so third-party software will be needed instead.

MAC OS X

Before performing a reset, make sure to sign out of iCloud, and deauthorise your iTunes account. The next step is to reboot the Mac into recovery mode — hold down both the Command and R keys during the boot-up process to access OSX Utilities. From there, select 'Disk Utility' and then select the drive to unmount, then erase. Quit Disk Utility and select 'Reinstall OS X', then follow the prompts to end up with a fresh copy of the OS.

ANDROID

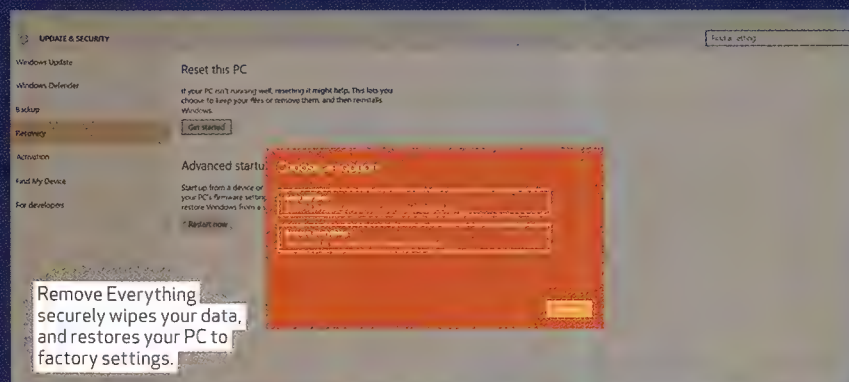
The process varies slightly for different Android versions and skins, but is generally very similar. Simply navigate to Settings, then select 'Backup and Reset', then 'Reset Phone'. On some devices, the reset option may be buried in another sub-menu — typically 'Privacy'. If you have Google's free Android Device Manager set up, you can also remotely perform a factory reset by selecting 'Erase'. You can also select to erase data on an SD card. Button combinations vary to enter recovery mode to perform a hard reset and wipe (for non-booting phones), so check with your manufacturer or online.

iOS

Head to 'Settings > General > Reset' and select 'Erase all content and settings'. You will need to enter your passcode, and the phone will be wiped back to factory settings. It is also possible to perform the wipe remotely, via iCloud. For non-booting devices, iTunes and a computer can be used to reinstall the OS. With the device off, connect it via USB cable to a computer running iTunes. Press and hold the home button until you see a lightning connector with an arrow pointing at an iTunes logo. From there, the iTunes will automatically detect the device and give an option to restore it.

WINDOWS PHONE

Navigate to 'Settings > About' and select 'Reset your phone' and tap 'Yes' (twice). You can also select an option to erase your SD card at the same time. Using Microsoft's Find My Phone, it is also possible to perform a reset remotely. For (some) non-booting Windows Phones, it is possible to perform a reset only using hardware buttons. Press and hold the Power and Volume Down buttons until it vibrates (10–15 seconds), followed by release both buttons, then pressing Volume Down until a large exclamation mark is displayed. Then press (but don't hold) Volume Up, Volume Down, Power and Volume Down in sequence.



"SSDs should be more secure (once properly erased), but in practice, many models do not fully overwrite data when they should."



Additional clean-up considerations

A FACTORY RESET IS ALL WELL AND GOOD, BUT WITH THE RIGHT SOFTWARE, THERE IS A POSSIBILITY THAT SOME DATA CAN STILL BE RECOVERED. HERE'S WHAT YOU NEED TO BE WARY OF.

Even after a format or wipe, specialist software can wind back the process and sniff out intact information. Mechanical HDDs are theoretically more vulnerable; with information recoverable even after it has been overwritten. SSDs should be more secure (once properly erased), but in practice, many models do not fully overwrite data when they should. While a device might seem fully and securely erased, some missed data could be lurking. Fortunately, there is a range of tools and utilities available that help make data very hard to recover.

ENCRYPTION

No matter what process or software is used, there is the (slightest) potential for information to remain. The best option for the security conscious is to first encrypt your entire device, then perform the factory reset or other secure erase. This means that, even if there is a problem and any data can be recovered, it will still be encrypted and extremely hard to crack. While not strictly necessary, for most devices, it's an easy way to make sure your personal data (almost) definitely can't be recovered.

ANDROID

Unless you have an ancient device, it should support encryption. On newer models, it's enabled by default, but on older models, it has to be turned on

manually. Before encrypting, you need 80%+ battery, and the phone charging. Open up 'Settings > Security' (or on some phones, Storage), then select 'Encrypt phone'. Depending on the version of Android in use, the exact location and wording can vary. After encrypting, an app such as SDelete – File Shredder (goo.gl/MiebhP) can be used to overwrite your devices storage to render personal information much harder to recover. The wipe can take an hour or two, after which, a factory reset will complete the process.

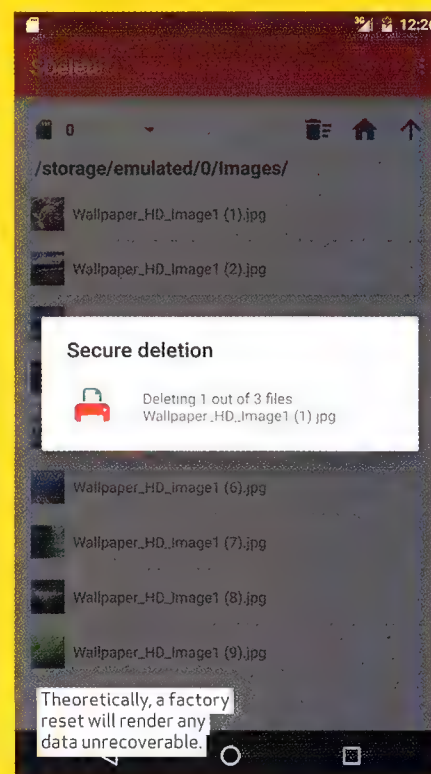
IOS

Unless you have a particularly old device, your Apple iPhone, iPod or iPad is already encrypted when you create a lock screen passcode. Performing a factory reset removes the ability to decrypt that data (at least in any reasonable way), so any personal data should remain secure. As such, Apple has actually removed 'Secure Erase' style software from the app store as 'misleading' and unnecessary. One low-tech option to at least overwrite some of the data storage (after a reset) is to record a long video until the phone is totally full, then delete it.

WINDOWS PHONE

In the latest Windows 10 Mobile, encryption is not enabled by default – head to 'Settings > Device Encryption' and turn the slider to 'On'. After encrypting the device, a factory reset

will render any data unrecoverable. With Windows Phone 8 or 8.1, it's not so simple. The OS supports encryption, but it can't be simply turned on. The phone must be managed by an external policy that activates the encryption. While possible to do, it's beyond the scope here.



THE SSD PROBLEMS

DO YOU KNOW THAT THERE ARE EXTRA SECURITY CONCERNS WHEN IT COMES TO WINDOWS DEVICES WITH SSDS?

Computer SSDs pose a dilemma for secure erasure, thanks to how they handle 'wear levelling'. Options such as writing over the data need to be performed multiple times to ensure that nothing is missed, which is slow and decreases drive lifespan. Many SSDs have secure erase commands built in, but in practice, these can leave some original data that can be recovered with forensic techniques. Like with smartphones, the best option is often to fully encrypt the drive, then destroy the key.

WINDOWS

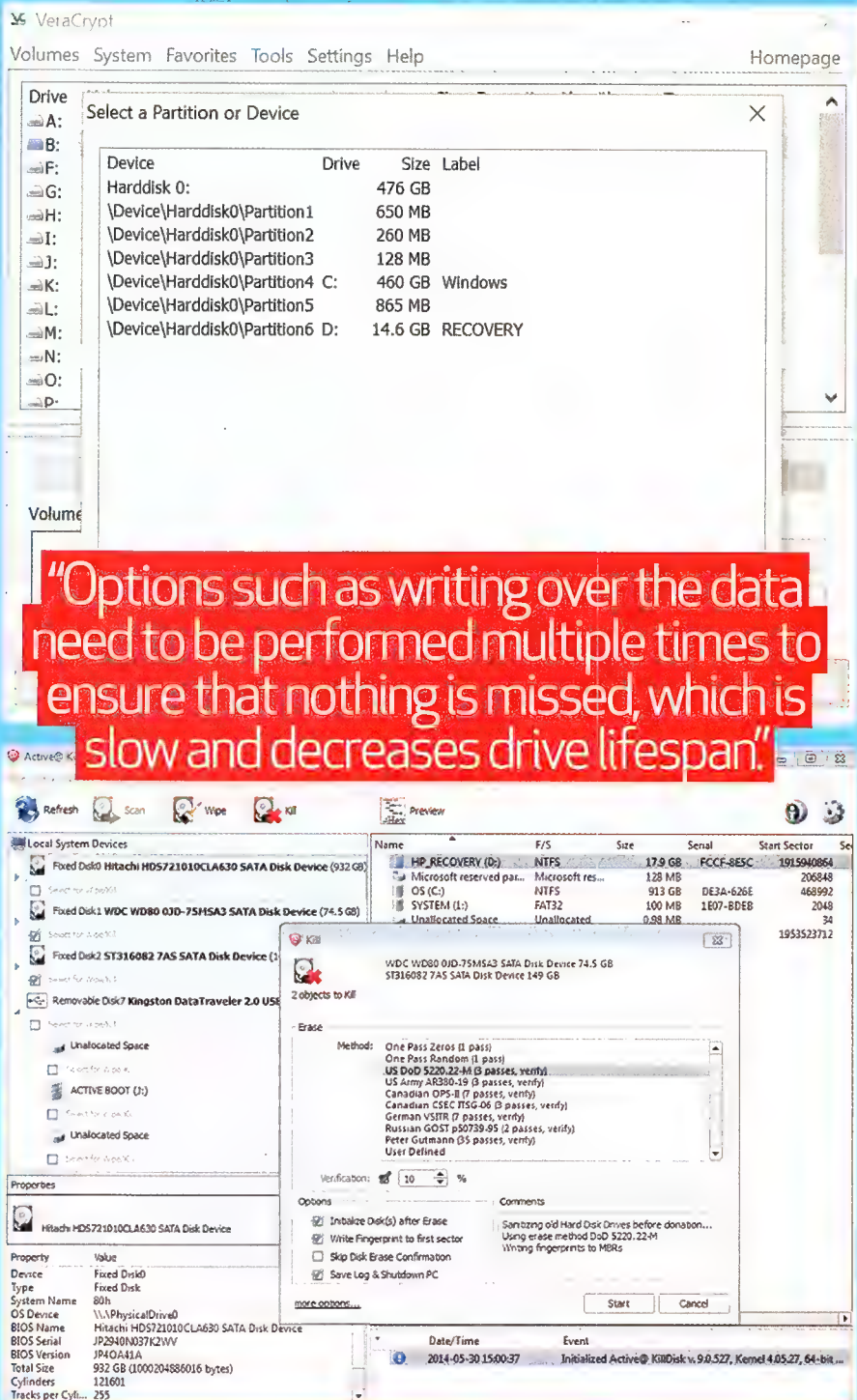
The 'Remove Everything' option in Windows 8 and 10 attempts to securely erase the drive by completely overwriting all the data. Performing a full drive encryption first adds an extra layer of protection, but not all versions of Windows have the option built in — only the Ultimate, Professional and Enterprise Editions, dating back to Vista. For those with lesser versions, the free and open-source VeraCrypt (www.veracrypt.codeplex.com) is a good encryption alternative. After installation, encrypting a drive can take many hours, but is worth the time and effort before erasing your files.

Windows 7 and earlier do not have factory reset options, but encrypting the drive, then formatting it and reinstalling Windows will make data extremely hard to recover.

MAC OS X

For those with a reasonably new Apple computer (running OS X Lion or later), chances are it already has full disk encryption enabled — called FileVault 2. It's an opt-out option during installation or upgrade and, for newer models, doesn't lower performance. To check FileVault status, or turn it on, navigate to 'System Preferences > Security & Privacy' and select FileVault. With the encryption turned on, erasing the drive and reinstalling the OS will be even more secure.

Unlike Windows, OS X also offers an option to securely erase any free space on your device, without having to perform a full install. This means that any deleted files will be completely overwritten, and be very hard to recover. This option is available in Disk Utility (see the above Mac OS X reset guide) but only for older models with mechanical HDDs.



ACTIVE KILLDISK

THIS FREE (WITH A PAID PRO VERSION IS AVAILABLE) UTILITY IS A GOOD OPTION TO SECURELY ERASE A COMPUTER'S HDD OR SSD.

It can run under Windows or Linux, or is available as a bootable toolkit for just about any computer, including a Mac. For total security (but extra hassle) the software can perform a full disk erasure, writing over all data, after which your OS will need to be reinstalled.

Alternatively, it can also just do a wipe of all unused data, such as deleted files, that leaves your OS and existing files and folders intact. Active KillDisk can also be used on external HDDs or other storage, and is a good way to securely erase any SD cards. It's worth noting that the software does not guarantee that all data will be securely erased, so it's best used alongside other options such as encryption and factory resets. Grab the free version at www.killdisk.com.

How and where to sell your tech

TURNING THOSE OLD OR SPARE DEVICES INTO COLD HARD CASH IS GREAT, BUT THERE ARE QUITE A FEW DIFFERENT OPTIONS AND HOOPS TO JUMP THROUGH TO GET THE BEST PRICE.

Generally, the more 'like new' you can present your second-hand tech as, the better. We've found it's always a good idea to keep the original box and packaging (and even the receipt), as well as all accessories – even if you don't use them. Give your device a thorough clean, too. Items such as phones which are kept in cases often give much better resale value. For older desktop PCs, the system as a whole might not be worth very much, and can be time consuming to sell and ship to a new owner. Sometimes, it is better to sell the best parts and simply recycle the rest. Even if you don't get as much money, the time saved on not having to wipe HDDs can be worthwhile.

PRICE EXPECTATIONS

A common mistake when selling second-hand tech is pricing it too high, or having unrealistic expectations. Do your research and compare to what other items are actually selling for – not just what they are advertised for. Factors such as location, condition, age,

warranty and accessories can make a bigger difference to the price than you might think. That said, expect lowball offers, and hold out for a fair price. Timing is also very important – for example, right after a new iPhone launches, the market will be flooded with older models from people upgrading; this will reduce the prices.

eBay (www.ebay.com.au) is a great choice for price research, as navigating to the advanced search gives the option to only show completed sales. This makes it very quick and easy to compare real-world prices, even if another platform is used to actually sell your device. For selling phones, there is even a page dedicated to making it easy to compare phone prices – check it out at www.ebay.com.au/s/phone.

LISTING FOR SALE

When selling tech, the difference between a good listing and a bad one can have a huge effect on the selling price. Pictures are vital – make sure

you cover every angle (with good lighting), get a shot of accessories and a close up of any damage, such as scratches. Create a comprehensive but concise description, with details such as the purchase date, how it's been used, any problems or damage, as well as your location suburb and contact details. It never hurts to include manufacturer specs and info – but don't just do a copy paste without a description of your actual device.

BROKEN TECH

Do you have a smashed phone screen, or fried computer? Don't despair, as a lot of damaged tech is quite easy to sell. Sure, it's not worth as much, but for some items (such as iPhones), you can still get a surprising amount of money. It's also worth comparing prices on getting it fixed first – but generally, you will not recoup the repair costs compared to just selling it broken. If the problem is not your fault (such as a finicky touchscreen), a warranty claim before selling is always a good idea. Don't be put off by a manufacturer's shorter 1 or 2 year warranty either – in Australia, all products are legally covered for a reasonable lifespan, regardless of what the warranty says.

SELLING ON EBAY

The biggest online marketplace in Australia, in more recent years



HOW MUCH IS YOUR SMARTPHONE WORTH ON EBAY?

Even old, broken and used phones are worth money. Find out how much.



Select a brand

Apple

Samsung

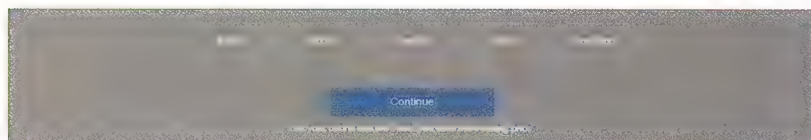
Nokia

HTC

LG

Sony

I can't find my brand



Top Questions

How much is my Smartphone worth?

How do I sell my Smartphone on eBay?

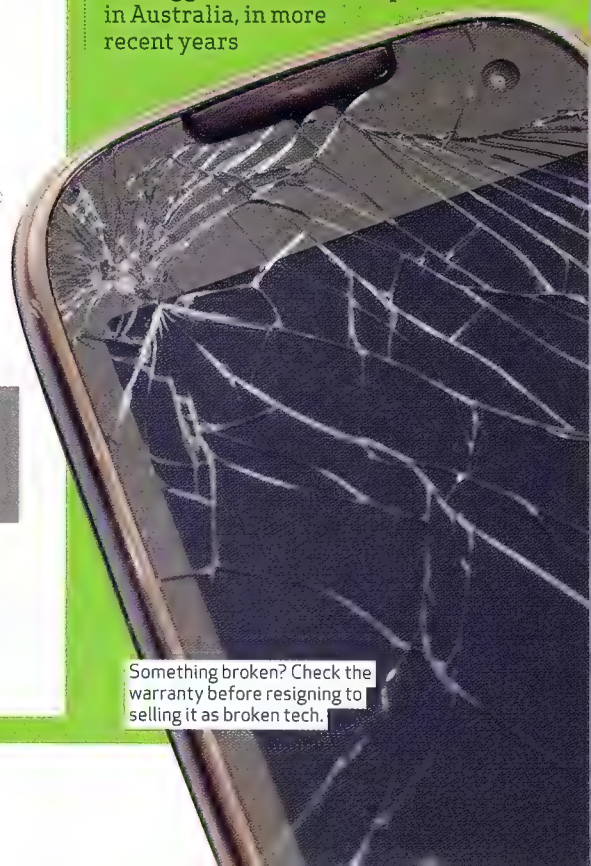
How much will I earn selling my Smartphone on eBay?

Compare how much other phones are selling for.

Sell your Samsung Galaxy
Sell your iPhone 6 Plus

Sell your iPhone 6s
Sell your iPhone 5

Sell your iPhone 6S Plus
Sell your iPhone 5s



Something broken? Check the warranty before resigning to selling it as broken tech.

eBay has become a less-hospitable environment for one-off sellers. That said, it still has a huge audience and often commands some of the best prices — along with a lot of competition from other sellers. Setting up a listing for sale is quite simple, and eBay walks you through the entire process. A basic listing is typically free, with paid upgrades to help your item stand out. The downside is that eBay charges a 10% fee of both the final sale price and any postage costs — if it sells. If you offer PayPal as a payment method, they also take a cut.

The classic auction style (3, 7 or 10 days long) often gets the highest price, but is slower. If the buyer doesn't pay (annoyingly common on eBay), you have little recourse aside from starting the auction again, or offering to sell for less to the second highest bidder. 'Buy It Now' sales can be faster, especially if priced competitively. eBay also has a classified option, which costs a flat \$19.99 to list, whether your tech sells or not.

One of eBay's other problems is the potential to be scammed. There is a lot of protection for the buyer, but as a seller, there are a few traps to avoid. Being willing to post your tech opens it up to more buyers, but always send it with both tracking and insurance. Be aware that a dissatisfied buyer (or scammer) can often return an item at your cost, and it can be hard to prove if a damaged or even different item is sent back.

GOING WITH GUMTREE

Actually owned by eBay, Gumtree (www.gumtree.com.au) is one of the largest and best places to sell your tech. It's free to list items, but there are also paid upgrades to give your sale a little more visibility. Gumtree isn't without its pitfalls and traps, though, and it can often be a very time consuming process to use. It's aimed at selling to local buyers, though there's nothing stopping you offering to post items.

As a classifieds-style website, rather than a marketplace, it's very simple to get started, and the website leads you through the process of putting an ad up.

The downside to Gumtree for selling tech is that, for popular devices, it gets flooded with ads that

use all the same keywords, so your device can become lost in the crowd. With thousands of new items added each day, your specific ad can quickly get pushed many pages deep from the front page. Many Gumtree sellers don't remove their ads after the item is sold either, so often for popular devices, only the first few pages get enquiries from buyers. Gumtree offers a paid upgrade to get your ad back to the top, or keep it there, but a cheaper option is to simply delete, then re-list your item.

Unlike the more regimented feel of eBay, Gumtree tends to have a lot of users looking for bargains. This can make for a frustrating selling experience, with large numbers of potential buyers getting in contact, but making only very lowball offers, and often asking questions already answered in your description.

Alternative selling options

IT'S NOT ALL ABOUT THE BIG NAMES — THERE ARE OTHER MORE LOW-KEY PLACES TO TRY, TOO

Aside from eBay and Gumtree, there is not a lot of competition. Quicksales (www.quicksales.com.au), The Trading Post (www.tradingpost.com.au) and Craigslist (craigslist.com.au) are some alternatives, albeit without as many users. Instead, it can be better to target nearby Facebook (www.facebook.com) buy and sell groups or the classified sections on local community forums.

SELLER SAFETY

While fairly rare, there are scams that target sellers of high-value tech items. Ideally, only ever accept cash or direct bank deposit for payments — never options such as Western Union. PayPal can be convenient, but leaves you open to various scams that attempt to recover the money without returning the item. Posting items gives you more potential buyers, but never send items until you have full payment. Make sure any tech is well padded and always use both tracking and insurance.

As an extra precaution when making an in-person sale, consider meeting in a public place and only accept cash.

BUYBACK SITES

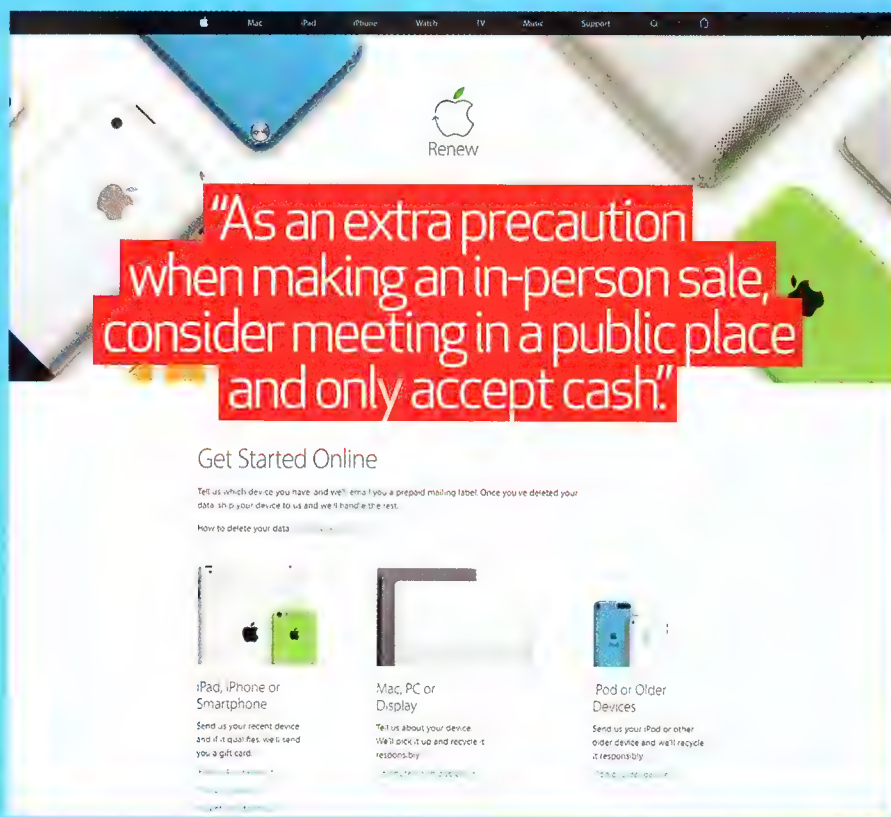
Rather than going through the hassle of selling a device yourself, some websites offer a simplified purchase option. Most are aimed at phones, but some cover other tech, such as laptops and consoles. The websites provide you a buyback quote based on the model and condition of the device. The price is typically a lot less than what you would get by selling yourself. For instance, an iPhone 6 in good condition can be sold to a buyback site for about 2/3rds of what you might get on Gumtree or eBay — a difference of up to \$200.

If the price is acceptable to you, the website sends out a return postage box (or you print off a postage slip), and you send in your phone. If the model and condition check out, the websites pay the quoted amount, or offer a lower value if there is any extra damage. Many of the websites will also buy back broken phones (such as smashed screens) for a lesser amount. There is a large range of buyback websites in Australia, and it can be worth comparing prices, but a good place to start is Fone Bank (www.fonebank.com.au). Other worthwhile sites include Mazuma Mobile (www.mazumamobile.com.au), Greener

Mobile (www.greenermobile.com.au) and Mobile Monster (www.mobilemonster.com.au). For tech other than phones and tablets, Boomerang Buy Back is worth a look (www.boomerangbuyback.com.au).

TRADE-INS

While mostly aimed at smartphones, some manufacturers and providers offer trade-ins for your old devices when you upgrade. Payouts (and the process itself) are similar to buyback sites and typically significantly less than what could be achieved in a private sale. Some providers, such as Optus (www.optus.com.au) give the trade-in value as a discount on future bills. Telstra (www.telstra.com.au) claim a maximum trade-in value at just \$250, but actually use Bounce Mobile (www.bouncemobile.com.au), which typically pays values similar to other buy back websites. Apple (www.apple.com.au) also offers a trade-in service, including other brands. The payout is in Apple Store credit, and the prices are typically a little better than other trade-in or buyback options.





Pro laptops to replace your desktop

Nathan Taylor tests six grunty laptops that can replace a traditional desktop PC.

You're looking for a new laptop and you'd like something with a little meat on it. Not one of those fancy ultra-portables or convertibles: something with a decent screen and enough power under the hood to get things done (even if those things are games). Portability isn't the priority: performance and screen size are.

If that's the case, you're looking for a desktop replacement laptop. That's a device with enough juice to reasonably replicate the desktop experience. They have powerful processors, screens of 15 inches and up, as well as far better graphics chips than most laptops.

This month, we're going to take a look at half a dozen of those, to give you a taste of what's on the market.

HOW WE TESTED

We tested the laptops with a variety of benchmarks. We used PCMark 8 from Futuremark (www.futuremark.com), which runs the laptop through a scripted set of tasks common to a particular activity, measuring how quickly it performs those tasks and giving a comparative score. We ran through both the home and work sets.

PCMark 8 also provides a battery rundown timer, running the benchmarks on a loop until the

battery kicks it. Note that this is best used as a comparison — PCMark hits the laptops harder than most users will, so the battery life listed is likely lower than you'd get in the real world.

Also from Futuremark comes 3DMark. We ran through a graphical sequence called Fire Strike, and 3DMark provides a comparative performance score.

Another 3D test is Cinebench R15 from Maxon (www.maxon.net). It uses OpenGL to run through a 3D rendering and provides a final average frame rate. It also uses ray tracing to perform a test of the CPU's 3D rendering capabilities.

Finally, we have Crystal DiskMark 3 (crystalmark.info), a hard drive performance test. We listed the sequential read/write speed of the primary storage device which gives you an indication of the peak performance of the device. We also listed the read/write speed when the data was transferred in 4K chunks. And finally, there's the 4K QD32 test, which creates a queue of 4K read/write operations (as opposed to handling them one at a time), letting devices with caching and queuing smarts to use those smarts to optimise the read/write operations.

Mobile graphics

No matter how much you're willing to spend, your laptop's graphics are never going to be as good as those on your PC.

For instance, the GeForce GTX 980M has only about 70% of the processing power and about half the memory bandwidth of the desktop GTX 980 processor. On the desktop, it would land somewhere between the GTX 960 and 970 — which isn't bad, since we're talking about \$250+ cards here — but it's not top-end.

As you might expect, it all comes down to power. The desktop GTX 980 will draw 165W when stressed to its maximum, while the GTX 980 Ti goes as high as 250W. Given that even a large laptop with an eight-cell battery might only have 80–90-watt hours of power, you can see how that might be a problem. So while mobile graphics have certainly improved a lot, if graphics are super-important to you, then the desktop is still the way to go.



17.3-inch screen, Intel Core i7-6700HQ 2.6GHz, 16GB memory, 256GB PCIe SSD + 1TB SATA HDD storage, NVIDIA GeForce GTX 980M 4GB GDDR5 graphics, 4x USB 3.0, 1x USB type-C, 4.3kg

\$3,239 | WWW.ASUS.COM.AU

ASUS ROG G752VY

All the best things.

Part of the excellent Republic of Gamers (ROG) line, the G752VY is for people who just want to say "Screw it! Give me all the things!" It has abig screen, SSD and hard drive, high-end processor, top-end GPU and an industrial design that's absolutely great for both gaming and work.

The backlit keyboard and silky touchpad are designed for gamers looking for maximum responsiveness. For a laptop, the keyboard is about as close as you can get to a mechanical one. There are special macro buttons.

The 17.3-inch IPS screen supports full HD display, and is driven by Nvidia's current top-end mobile GPU, the GeForce GTX 980M. Those pushed it to near the top of the performance tables in our 3D tests. All that power requires a good cooling system, and the G752VY can get a little blowy when stressed.

The performance of the PCIe SSD, meanwhile, was straight up bananas. With

queue depth switched on, it was achieving sequential reads in excess of 2GB per second. On the more regular tests, it still read at over 1.5GB/sec. The SSD pushed the laptop to extremely high general usage performance as well. The laptop also includes a 1TB hard drive.

All these features come at a cost, in both money and weight. Lugging around this 4.3kg monster and its huge power brick isn't going to be fun, and it hits just over \$3,000 at retail. Its power consumption is considerable, and even its 88Wh battery struggled to match its competitors' lifespan. But if you want performance that's as close to a desktop as you can get, that's the kind of price you have to pay.

Verdict

It's a monster, but if you want a semi-portable powerhouse, this is your gear.



15.6-inch screen, Intel Core i7-6700HQ 2.6GHz, 8GB memory, 1TB 5400 rpm SATA Hybrid hard drive, NVIDIA GeForce GTX 960M 4GB GDDR5 graphics, 3x USB 3.0, 2.57kg

\$1,999 | DELL.COM.AU

Dell Inspiron 15 7000 series (7559)

For the more business-minded.

The Dell Inspiron is the polar opposite of devices like the ASUS G752VY and MSI GT72S. In contrast to their flashiness, the Dell is staid and business-like. There's no weird coloured keyboard backlights or 'game enhancement' software, no big flair on the casing, no fancy PCIe SSD installation. It's a simple, elegant and business-like device.

The GeForce GTX 960M graphics processor is only mid-range (though at the upper end of mid), the default memory is 8GB of DDR3 and there's no SSD. Instead, it used a hybrid 1TB hard drive with 8GB of flash storage for caching.

Those more modest specs meant that it wasn't terribly competitive on performance with the other devices we tested here. The lack of an SSD in particular hurt it, although it wasn't as far off the mark as you might think in the overall performance tests. It also performed well in our battery life tests, with

the 74Wh battery giving it a longer life than any of its competitors.

It's also comfortable and easy to use. Although we prefer larger touchpads, this one works great, and the rubberised keyboard deck makes it very comfortable use. The keyboard has a simple white backlight and relatively shallow keys designed for faster typing rather than precision gaming.

With a sale price considerably less than some of its competition, the Inspiron 15 7000 series is genuinely good value. It doesn't cram in all the latest tech, but if you're not into that anyway and just want something that's smooth and comfortable to use, Dell has the goods.

Verdict

An elegant laptop for people who don't the absolute latest specs.





17.3" screen, Intel Core i7-6820HK 2.72GHz, 16GB memory, 2 X 128GB M.2 SSD + 1TB SATA HDD storage, NVIDIA GeForce GTX 980M 8GB GDDR5 graphics, 6x USB 3.0, 1x USB type-C, 3.78kg

\$3,700 | AU.MSI.COM

MSI GT72S 6QE Dominator Pro G

More power than any laptop before it.

Like the ASUS ROG G752VY, this is built to be the ultimate performance laptop, trading portability for a 17.3-inch screen and all the mod-cons. It actually one-ups the ASUS on having a faster CPU, as well as twice as much memory for the GeForce GTX 980M graphics chip. It has expansion for up to 64GB of memory, as well as a USB type-C/Thunderbolt port. It also boasts two 128GB PCIe SSDs configured in RAID 0.

That performance was staggering. Crystal DiskMark clocked its sequential read speed at over 2.6GB/s. The 4K writes brought it closer to the speed of ASUS's single PCIe SSD, however. It comes with an additional 1TB SATA hard drive for when you need more space than the SSD supports.

In other benchmarks, it beat most other laptops tested, and was only really rivalled by the ASUS. Only when it came to battery life

did it disappoint. We were also less thrilled by its design. The multicoloured keyboard backlight is a tad tacky. The full HD display is merely 'okay'.

That said, the keyboard is fantastic, with deep, well-defined keys perfect for gaming or typing. The touchpad is large and smooth, although we would have preferred a greater slope at the front of the keyboard. The case does feel flimsier than the ASUS, but it's also considerably lighter.

When it comes to 'ultimate laptop' options, we'd probably still favour the ASUS for its physical design. The performance and specs of the MSI can't be denied, however, and if you're looking for the very best laptop tech, this has it.

Verdict

The king of specifications. Good keyboard and audio as well.



apc
HOT PRODUCT

15.6" screen (4K), Intel Core i7-6700HQ 2.6GHz, 8GB memory, 128GB M.2 SSD + 1TB SATA HDD storage, NVIDIA GeForce GTX 970M 6GB GDDR5 graphics, 2x USB 3.0, 1x USB type-C, 1.9kg

\$2,900 | AU.MSI.COM

MSI GS60 6QE Ghost Pro 4K

Beautiful and powerful, with a 4K screen.

MSI's new GS60 makes the fewest compromises we've seen in a desktop-replacement notebook. It's slim, has an incredible screen, high performance, has multiple-storage devices, boasts a wonderful design and still comes in at less than 2kg.

The screen is a genuine 4K display on a 15.6-inch laptop. It can also output 4K to two other screens through HDMI and DisplayPort output; three, if you count the Thunderbolt/USB 3.1 port. The speakers produce a sound quality a cut above your regular laptops, and the SteelSeries-designed keyboard is made for gamers, with deep travel and wide button spacing, and is backlit in red.

To drive the display, it comes with a GeForce GTX 970M with 6GB of memory, a modest step down from the top GPU. That still produced very acceptable tests results in our 3D tests. It also performed well in the

disk tests. The Ghost Pro uses an M.2 SSD as primary storage, with a hard drive secondary. Total system performance was about the same as the Metabox Prime P650RE — it was at the low end of our comparison, but hardly poor.

However, with only 52Wh battery power to work with and an ultra-HD screen to drive, its overall battery life was a little lacking. You'll likely have to take the mid-size power brick with you when you travel.

But battery life aside, this is a phenomenal laptop, and our pick of all the devices we've looked at here. It's wonderfully portable, elegantly designed, has an amazing screen and still plenty of power.

Verdict

Amazing. A 4K screen and a slimline chassis, with great performance parts under the hood.





15.6" screen, Intel Core i7-6700HQ 2.6GHz, 8GB memory, 250GB SATA SSD, NVIDIA GeForce GTX 965M 2GB GDDR5 graphics, 4x USB 3.0 ports, 2.4kg

\$1,713 | WWW.METABOX.COM.AU

Metabox Alpha N150RF

The laptop you make.

Where other manufacturers might let you customise a few things, with Metabox, every expansion slot is open for you to choose. Select a chassis, choose your options and Metabox will build to order. You don't even need to have an OS installed. Even the casing material and design can be chosen.

The Alpha N150RF is a mid-range option with fewer customisation options than the Prime 650RE (right). It includes a slot for an optical drive (occupied by a DVD-RW on our test system) and has a VGA port, DisplayPort and HDMI for all your external monitor needs.

Internally, our test system came with an Intel i7-6800HQ processor and GeForce GTX 965M GPU – these components are unchangeable. What you can select is what goes in the M.2, hard drive and optical drive slots. In this case, it was a 250GB SATA SSD and a DVD-RW drive (with the

hard drive bay empty). Those produced very solid performances in our benchmarks across the board.

We don't particularly love the default design; it's staid and kind of boring, with slightly tinny speakers and an okay full-HD screen, along with a plain, softly backlit keyboard. There's plenty of ventilation and it stays cool and quiet enough during regular operation, and the generous palm rests and responsive touchpad make it pleasant to use.

Still, if you want customisation, we'd recommend the Metabox Prime P650RE. The Alpha N150RF might not be quite customisable enough to justify its ho-hum design for some.

Verdict

A lacklustre design, but great build options and value. Good battery life.



15.6" screen, Intel Core i7-6700HQ 2.6GHz, 16GB memory, 256GB SATA SSD, NVIDIA GeForce GTX 970M 3GB GDDR5 graphics, 4x USB 3.0 ports, 2.49kg

\$2,133 | WWW.METABOX.COM.AU

Metabox Prime P650RE

Super-customisable.

The Prime P650RE is built around the philosophy of letting you decide what's in your notebook. It looks extremely similar to the Alpha (left), with the main difference on our test system being a brushed metal finish rather than the matte of the Alpha, but inside the box is a whole lot of difference. Where the Alpha lets you select a few slot fillers, the Metabox Prime cranks the customisation up to 11 and rips off the dial.

You can choose an FHD or 4K screen (our test system had full-HD). You can choose how much graphics memory you have (3GB in our case); what processor it has (i7-6700HQ); how much memory you have, up to 64GB (we had 16GB); and most importantly what storage devices are installed. There are two M.2 slots to fill – one of which supports PCIe connectivity – as well as two hard drive bays, allowing up to four storage devices total. Our

test system has a single SATA SSD in it. There is no internal optical bay.

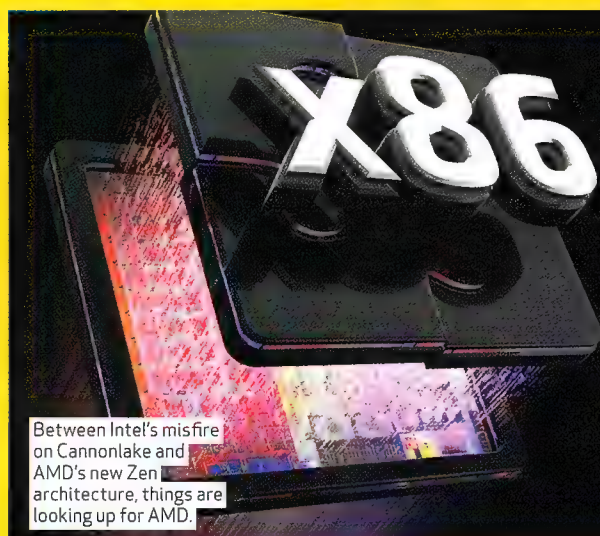
It's a little disappointing that the laptop has no USB 3.1 or Thunderbolt support, although it does come with two DisplayPorts, as well as HDMI, making it great for a multi-monitor home setup. We weren't particularly enamoured by the softly-backlit keyboard, with too short a travel making it hard for precision typing and gaming. The touchpad was perfectly fine, however.

As with the Alpha, the industrial design of the Prime is a little meh. It feels absolutely solid, and there are options to add a textured carbon wrap, but it's not a device that will have you feeling the wow.

Verdict

Love the customisation, don't love the base design.





“ZEN”

- ▲ Totally New High-performance Core Design
- ▲ Simultaneous Multithreading (SMT) for High Throughput
- ▲ New High-Bandwidth, Low Latency Cache System
- ▲ Energy-efficient FinFET Design Scales from Client to Enterprise-class Products
- ▲ Availability in 2016

What's next for laptop CPUs?

We could see some surprising developments in the near future when it comes to mobile processors.

Intel

Intel's processor strategy has, for the last few processor generations, relied on a 'tick-tock' strategy. An architecture update would be followed by a manufacturing process shrink, which would, in turn, be followed by another architecture update and so on. That's set to change, as delays in Intel's upgrade to a 10nm process have scuttled its original plans.

Right now, Intel's top-of-the-line mobile processors (including the processors used in all the laptops reviewed) use its Skylake architecture, which, like its predecessor Broadwell, is manufactured with a 14nm process. It offered a number of modest

storage architecture. In short, it's another modest upgrade that will probably go unnoticed by most users (unless Optane really takes off, which, if Intel's claims about its performance are in any way accurate, it might).

The real movement doesn't come until Cannonlake in late 2017. That's when Intel will move to its 10nm process, improving performance-per-watt significantly. We don't know the clock speeds it will be available at, but you can expect a significant jump in performance.

Following Cannonlake, Intel has Icelake and Tigerlake in 2018 and 2019, respectively. These are architecture upgrades, although we don't yet know what they include.

“The real movement doesn't come until Cannonlake in late 2017. That's when Intel will move to its 10nm process, improving performance-per-watt significantly.”

improvements over the previous platform, including a significantly better GPU (Intel Graphics 530) and better power control to lower overall consumption.

Another upgrade is due towards the end of this year. The upcoming 14nm Kaby Lake processors will have integrated USB 3.1 support (other platforms require a third-party chip), another upgrade to the GPU with support for hardware decoding of 10-bit HEVC video as well as native support for Intel's new Optane memory and flash

Intel even has a preliminary roadmap beyond that. Leaked reports indicate it plans to move to 7nm by 2020 – a mark that was once thought impossible on silicon. Manufacturing rival TSMC plans to go 7nm even earlier – as soon as next year, and into 5nm territory by 2020 (possibly using indium gallium arsenide in lieu of silicon). Beyond 5nm is even possible, with carbon nanotubes promising feature sizes as little as 1nm across. All of which is to say: Moore's law has some juice in it yet, and Intel will likely be right there.

AMD

Although it hasn't been a big player in the mobile space for some time, AMD still has the potential to make a comeback. For one, Intel's substantial manufacturing process advantage over AMD is potentially set to disappear. This year, AMD is moving to a 14nm process, which is the same as Intel is using in its high-end processors. Current AMD CPUs use 32nm and 28nm processes.

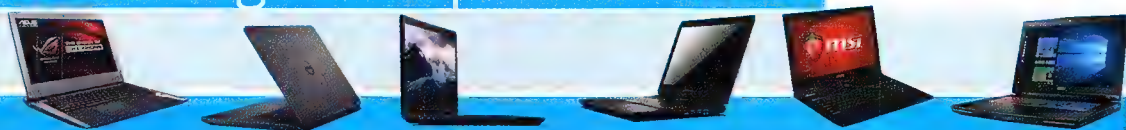
With Samsung and TSMC starting 10nm manufacturing late this year and early next, AMD may even steal a jump of Intel, which won't be making 10nm chips until mid-2017. Now that it's no longer vested in GlobalFoundries (which has historically struggled to keep up with Intel), AMD can use these other manufacturers to potentially put out chips that rival or exceed the performance-per-watt of Intel.

In addition to the improved manufacturing process, AMD is moving to a completely new architecture. At the end of this year, AMD will introduce the new 'Zen' architecture, which will completely replace the current 'Bulldozer' core.

According to AMD, it will have up to 40% better performance-per-clock than the current gen, and will support simultaneous multithreading, similar to Intel's hyperthreading. It will also support DDR4 and high-bandwidth memory (HBM). It will come on desktops first, with mobiles likely to follow next year.

With AMD already having a significant integrated GPU advantage over Intel, it will certainly be worth keeping an eye on its processors over the next few years.

"With Samsung and TSMC starting 10nm manufacturing late this year and early next, AMD may even steal a jump of Intel, which won't be making 10nm chips until mid-2017."



	ASUS ROG G752VY	DELL INSPIRON 15 7000 SERIES (7559)	METABOX ALPHA N150RF	METABOX PRIME P650RE	MSI GS60 6QE GHOST PRO 4K	MSI GT72S 6QE DOMINATOR PRO G
STREET PRICE	\$3,239	\$1,999	\$1,568	\$1,918	\$2,900	\$3,700
CPU	INTEL CORE I7-6700HQ	INTEL CORE I7-6700HQ	INTEL CORE I7-6700HQ	INTEL CORE I7-6700HQ	INTEL CORE I7-6700HQ^^	INTEL CORE I7-6820HK
- CORES/THREADS	4/8	4/8	4/8	4/8	4/8	4/8
- FREQUENCY RANGE	2.6GHZ	2.6GHZ	2.6GHZ	2.6GHZ	2.6GHZ	2.72GHZ
MEMORY	16GB	8GB	8GB	16GB	8GB	16GB
GPU #1	INTEL HD GRAPHICS 530	INTEL HD GRAPHICS 530	INTEL HD GRAPHICS 530	INTEL HD GRAPHICS 530	INTEL HD GRAPHICS 530	INTEL HD GRAPHICS 530
GPU #2	NVIDIA GEFORCE GTX 980M 4GB GDDR5	NVIDIA GEFORCE GTX 960M 4GB GDDR5	NVIDIA GEFORCE GTX 965M 2GB	NVIDIA GEFORCE GTX 970M 3GB	NVIDIA GEFORCE GTX 970M 6GB DDR5	NVIDIA GEFORCE GTX 980M 8GB GDDR5
HARD DRIVE(S)	256GB PCIE SSD + 1TB SATA HDD	1TB 5400 RPM SATA HYBRID HARD DRIVE WITH 8GB CACHE	256GB SATA SSD SAMSUNG 850 EVO	256GB SATA SSD SAMSUNG 850 EVO	128GB SATA SSD + 1TB SATA HDD	2 X 128GB PCIE SSD (IN RAID 0) + 1TB SATA HDD
OPTICAL DRIVE	6X BLURAY RW	NONE	DVD+/-RW	NONE	NONE	BLURAY RW
OS	WINDOWS 10 HOME	WINDOWS 10 PROFESSIONAL	NONE (WINDOWS 10 HOME TESTED)	NONE (WINDOWS 10 HOME TESTED)	WINDOWS 10 HOME	WINDOWS 10 HOME
TOUCHSCREEN	NO	NO	NO	NO	NO	NO
SCREEN SIZE	17.3-INCH	15.6-INCH	15.6-INCH	15.6-INCH	15.6-INCH	17.3-INCH
RESOLUTION	1920 X 1080 (16:9)	1920 X 1080 (16:9)	1920 X 1080 (16:9)	1920 X 1080 (16:9)	3840 X 2160 (16:9)	1920 X 1080 (16:9)
WI-FI TYPE	802.11B/G/N/AC	802.11B/G/N/AC	802.11B/G/N/AC	802.11B/G/N/AC	802.11B/G/N/AC	802.11B/G/N/AC
ETHERNET	GIGABIT	GIGABIT	GIGABIT	GIGABIT	GIGABIT	GIGABIT
USB	FOUR USB 3.0 + ONE USB 3.1	THREE USB 3.0 PORTS	FOUR USB 3.0 PORTS	FOUR USB 3.0 PORTS	TWO USB 3.0 + ONE USB 3.1	SIX USB 3.0 + ONE USB 3.1
WEBCAM	720P	720P	1080P	1080P	1080P	1080P
BATTERY	88WH	74WH	60WH	60WH	52WH	83WH
WEIGHT	4.3KG	2.57 KG	2.4KG	2.49KG	1.9KG	3.78KG

PRO LAPTOPS BENCHMARK RESULTS

	ASUS ROG G752VY	DELL INSPIRON 15 7000 SERIES (7559)	METABOX ALPHA N150RF	METABOX PRIME P650RE	MSI GS60 6QE GHOST PRO 4K	MSI GT72S 6QE DOMINATOR PRO G
PCMARK 8						
- HOME (ACCELERATED)	4873	2943	3278	3802	2925	4810
- HOME BATTERY (ACCELERATED)	2:35HR	4:16HR	3:28HR	2:52HR	1:49HR	1:53HR
- WORK (ACCELERATED)	5359	4245	4542	4922	4477	5283
- WORK BATTERY (CONVENTIONAL)	4:17HR	5:32HR	4:35HR	4:05HR	3:06HR	3:34HR
CRYSTAL DISKMARK 3						
- SEQUENTIAL READ/WRITE	1555/1285	101.4/114.3	498.9/485.9	507.7/482.6	496/553.8	2632/1343
- 4K	50.92/166.2	1.2/1.4	35.3/84	46.3/109.5	47.7/98.8	43.7/123.2
- 4K QD32	499.1/377.2	1.6/2.1	350.5/307.2	327.1/297.8	308/219.9	542.1/455.1
CINEBENCH R15						
- OPENGL (FPS)	99.62	72.21	89.48	96.62	94.3	101.49
- CPU (MULTI-THREADED)	666	679	673	680	671	701
- CPU (SINGLE-CORE)	142	141	142	142	140	136
3DMARK (2013)						
- FIRE STRIKE	8371	5002	5,365	6,708	5,997	8,253

Getting to the point

Ten of the latest gaming mice get reviewed and rated by Ian Evenden.

In this fine country of ours, the right to excess is absolute. Sure, you can play games with a lump of plastic that has two buttons and a wheel, plus some sort of movement sensor. Maybe even with a trackpad. Coupled with a keyboard, you can beat anything from an RTS to an FPS to a point-'n'-click adventure. So why do better? Why do you need 12 programmable buttons, a sensor with an ungodly resolution and a whisk attachment for omelets? It's down to two things: control and options.

The first can be control of movement or control of interaction, and comes down to how fast you need to react. Playing something like *XCOM 2* doesn't require the same sort of reactions as *Homeworld: Deserts of Kharak*, and the dedicated Kharak player may well want to send her pointer zooming across the screen at great speed, stopping it with precision on a particular unit. And for that precision you're going to want a high polling rate, which directly affects how often the mouse's position is relayed back to your PC. The higher the better.

Control of interaction relates to the buttons' programmability. Almost all gaming mice now come with software to control their functions. Being able to map a grenade throw that's just a click of a bumper button on a console controller to an extra button on a mouse can speed up your play and make you more effective in combat. One function that's often fixed is the rocker switch on top of the mouse, which alters the DPI rate on the fly, and the 'sniper button', if present, lowers the DPI rate so your aim doesn't wobble

when you're trying to draw a bead on an opponent's skull.

These, then, are the latest and possibly greatest gaming mice. Enjoy.

USELESS UPGRADES?

This year's crop of gaming mice has something in common: useless lighting. It's a customisation option that's often mocked in these pages, because it adds nothing to functionality.

The pointlessness of having a mouse that lights up is compounded by the way mice are used – your hand covers them 100% of the time they're in use.

Valve showed us, with its hats and other cosmetic items in *Team Fortress 2*, that people were willing to part with cash for upgrades that don't upgrade. Introduced in 2009, there are over 1,200 such 'upgrades' for sale on the *TF2* store, although premium account holders can get them as random item drops, too. 67% of *TF2* players own a mask that makes them look like an adorable baby seal, although only 7% of them equip it. In *League of Legends*, cosmetic upgrades are the only things locked behind a paywall – anything else can be purchased with XP points.

What does this tell us? Well, mainly that people like shiny things. Research from the University of Houston can shine some light on one reason why: it all comes back to water. The attractiveness of a shiny surface is hardwired into us because we once depended on rivers and lakes for water. This manifests itself at an early age – an experiment showed that babies were more likely to put glossy plastic plates in their mouths. From here, as we age, shininess or brightness

becomes associated with the fulfillment of needs and living the good life. It's only a short distance from there to making your PC flash bright green or blue.

Buying a mouse with lighting, because you believe it will more strongly fulfill your needs, would be a poor choice, however. That moment when your mum, who hasn't bought a new mouse in 20 years, admires the lighting is a fleeting one. Lighting effects are now so prevalent that they go unremarked by anyone who's flicked through an online store recently.

Basically, lighting up your mouse is BS – something we strive to have a minimum of here. It makes no difference to how the mouse functions or how it's used.

What's not BS, and can have a real effect on the way your mouse moves and feels, is weighting – something we're seeing less of this year as the focus has altered to pointless cosmetic enhancements.

Adding weight to a mouse adds inertia, the resistance of a physical object to any change in its state of motion. If more force is needed to start your mouse moving, or to make it deviate from its present course, any tiny adjustments, applied without thinking and with little energy behind them, are evened out. Your movements should be smoother and more accurate as a result, perhaps combining with the sniper button for ultimate accuracy.

So if you're playing a game that requires long, smooth, uninterrupted motions, consider adding more weight to your mouse. If it needs lots of small, jerky motions – especially if you need



This horde of gaming mice contains mostly optical sensors, but laser sensors are also popular.



An MMO mouse has a button grid, like a keyboard's number pad, which can be programmed.

the pointer to stop quickly, as inertia also governs how easy it is to arrest movement – look into making your mouse as light as possible.

In some models, the weights are arranged in such a way as to balance the mouse. A cartridge of individual lumps of metal can be customised to place all the weight on the left side of the mouse, for example, which makes a difference if you lift it off the table often. The natural position of your right thumb (if right-handed) tends to lift the left side of the mouse in this situation, potentially causing it to scrape on the pad or making it harder to replace it flat on the surface immediately. Increasing the weight of this area can help prevent this, leading to a smoother repositioning and a quicker return to the action.

Something else can override all this and make a bigger difference to your success with a particular mouse, however: comfort and familiarity. If the mouse digs into your hand or scrapes your fingers, no amount of weight management is going to turn it into a match-winner. The same goes for your fingers' ability to find buttons without you looking, and without you even consciously thinking. This kind of speed is only achieved with practice, and long familiarity with your mouse. Changing brands or even models could lead to a change in your kill-to-death ratio if you're climbing the leagues of competitive multiplayer, or a lot of frustration if you're trying to get those last stealth achievements in *Hitman*.

Handedness is also an issue. Many left-handers have adapted to using a mouse in their right hand, as devices

designed for southpaws are few and far between. Razer sells a left-handed version of its popular DeathAdder gaming mouse, but any lefties liking the look of Logitech's loveliness will be left in low spirits. The same goes for the strange MMO mice, with a whole numeric keypad bulging from their side as if they've received a large dose of radiation. They're built around the thumb of the right hand, making their use by a leftie at first seem hopeful – as the buttons fall under your more dextrous fingers – then hopeless as the shape of the mouse body makes it an uncomfortable endeavour. Perhaps the best option is to go for an ambidextrous model, of which we have a couple on test here.

Programmability of buttons can be of some help if you're struggling with your mouse, but it's never going to flip a right-handed mouse into a left-handed model. The most common mouse interactions outside of gaming are clicking a window's close button and hitting the back button in a browser. Being able to program additional buttons to carry out these tasks can speed up your interactions with your PC, and a particular favourite of ours is being able to program the wheel, in models where it clicks left and right, as well as down, to scroll left and right, complementing the vertical scroll of the rolling wheel. This tames large documents, especially in photo-editing or publishing applications, and helps out with those annoying web pages that don't perfectly resize to a snapped browser window.

While there's more to a gaming mouse than just gaming, the majority of these models are going to appeal to those who like to shoot, fly or micromanage.

Despite what controller manufacturers would like you to think, the mouse and keyboard combo has yet to be beaten as a PC game control scheme, and absolutely any of those scattered over the following pages would make a fine upgrade from the two-button-and-a-wheel device that sits by so many PCs. Whatever you want from a mouse, there's bound to be something out there that appeals.



Logitech's weight system enables you to change the balance of the mouse, and how much resistance it puts up.

Lightness of being

Could all these glowing peripherals make us fatter?

The rising Australian obesity rate has been attributed to everything from high-calorie diets to sedentary lifestyles, but we would like to propose another possible cause: mouse lighting systems.

A huge 62.8% of Australian adults are considered to be overweight or obese, while that number for children (aged 2-17) is one in four.

Alarmed, we put down our triple-fillet Bondi burgers and Dagwood dogs and turned our minds to the 2010 publication of a paper from Ohio State University, in *Proceedings of the National Academy of Sciences*, which examined how night-time light can affect weight, body fat and glucose intolerance in male mice (the animal kind). The study discovered that persistent exposure to a little light, when it should be dark, leads to increases in all three.

Light's role as a regulator of the body clock is already well understood, and a genetic cause for obesity has been identified, again, in mice. Ohio State wanted to test the effect, if any, of ambient lighting on waistlines. The mice were split into three groups. One group was kept in natural lighting conditions, one was exposed to 24-hour daylight and the last group was kept in a natural cycle but with a dim glow instead of true darkness at night. Each group was fed comparable amounts and was not stopped from moving around.

After eight weeks, the mice who'd had more light at night had put on 50% more weight than those kept in a natural cycle. They also put on more fat, rather than increased muscle, and showed a decreased tolerance to glucose in their bloodstream, a symptom often associated with diabetes later in life.

Now, if dim lighting can make a mouse fatter, imagine what dim lighting from a mouse does to you! [You're fired — Ed.]



Many manufacturers like to illuminate their logo, which seems silly as it's under your palm.



\$39 | GAMING.COOLERMASTER.COM

Cooler Master Xornet II

Redesigned but still a little weird.

For the claw gripper, the Xornet II may feel a little unusual. It's been redesigned from its previous state, and now sports a new sensor, altered button shapes, a light-up scroll wheel and a more firmly attached cable.

A ledge on the right is easy to mistake for the right button, and it's simply uncomfortable if you try to palm it, seeming to twist off to the left under your hand. At 0.3 lb, it's relatively light, and there's no way to alter that weight.

The matte black finish is classy, with the kind of microtextured grippy side panels that will endear it further to its target audience. The onboard switches are Omrons. There are only two extra buttons, to make a total of seven, including DPI changers and wheel, and the optical sensor's maximum sensitivity is 3,500dpi — although that's an improvement of 1,500dpi over the previous version.

This lack of features is a shame, but contributes to keeping the price down. There's a limited audience out there for a mouse like this, and studding it with the kind of extras that would push up its cost would limit it further.

The grip is what will draw people to this mouse, and probably what will make them stay. The fact that it's very reasonably priced helps, but some will pick this over devices that offer greater resolution, more buttons or grippier finishes, just because it works for them. If you like to feel full contact between your palm and the back of the mouse, walk on by, but for anyone who likes to keep their fingers stiff while gaming, this is well worth a try.

Verdict

Nicely updated claw-grip mouse; light and cheap.



\$78 | WWW.CORSAIR.COM

Corsair Sabre Optical RGB

A solid performer at a reasonable price.

The Sabre is very lightweight, moving easily across any surface, and changing direction with minimum effort. It's fairly low and wide, designed for claw grippers, but is more forgiving to the palmer than the Xornet II. There are eight programmable buttons, including the wheel, with Omron switches rated for 20 million clicks, and a very nicely braided cable that stretches 5.9 feet toward your USB port of choice.

The optical sensor resolution tops out at 6,400dpi and there are no weights to increase the heft. The smooth top surface makes moving between the narrow main buttons and the wheel simple — there's no doubt where one ends and the other begins when all you've got to go on is the feedback of your fingertips. Below the side buttons sits a recessed groove for your thumb, but these buttons aren't of the angled type, which can be pressed by

rolling your thumb up — you have to move it to push them. A shame, as the presence of the groove is crying out for such a movement-saving design.

Lighting is configurable across four zones, which can display the same or different solid colours, as well as changing patterns. It's all programmed with the PC software package, and the mouse contains a small amount of storage to save profiles to.

Such a basic model thankfully sells for a reasonable price. The Sabre is a solid, if unremarkable, performer at one of the most contested price points — its selling point is probably its light weight, and we're not sure that's enough to make it stand out.

Verdict

Reasonably priced mouse; lightweight.





\$108 | WWW.CORSAIR.COM

Corsair Scimitar RGB

Just how many buttons do you need?

The Scimitar suffers from the same problem we have with all MMO mice: using the damned thing. The buttons come in alternating lines of rough and smooth textures, but it's not enough. We found it hard to tell where our thumb was on the array without looking, and reaching all the way back to 10, 11, and 12 meant a complete repositioning of the hand. You can still click the primary buttons with your finger about halfway down them, but go any further toward the rear, and they are unpressable.

The wheel is a little loose, but turns with a positive notchiness. The body of the mouse is very big, which could be seen as an advantage. The right thumb is freed of any support duties and left to dangle over the button array, doing a one-legged jig across the world's most complex game of *Dance Dance Revolution*, and probably comes down to the challenge of fitting 12

buttons, with their switches and support frame, vertically on the side of a mouse. Those of a small-handed disposition may find it a bit of a stretch. An included tool engages with a hex nut on the base to shift the keys around a bit, so you can get them just right.

The sensor is a reasonably impressive 12,000dpi optical model and the software that comes with the Scimitar enables not only the programming of the buttons for single keystrokes, but for macros made up of multiple presses, too — and, yes, you can mess with the lighting if you like. This is another specialised mouse, with a particular audience in mind. We just hope that audience has big hands.

Verdict

Many, many buttons; large and solid.



apc
HOT PRODUCT

\$95 | WWW.LOGITECH.COM/EN-AU

Logitech Proteus Spectrum G502

The best mouse of 2015 gets a colourful update.

Pardon us for being subjective, but this could be the best mouse we've ever used. And we've used a few. This model replaces the Proteus Core, which we liked a lot.

The new G502 is tall and solid, making its presence known in your palm, yet still being light enough to push around easily. If too light, there are five -3.7g weights, shaped like futuristic boomerang bullets, that fit in the base, enabling you to move the centre of mass.

With a body that looks like something Adam Jensen of *Deus Ex* would use, it's certainly a futuristic design that stands out. Only the RAT series from Mad Catz looks more aggressive. The upshot of this is that the Logitech feels slightly different to use from other mice, but the body is so comfortable, you'll become familiar with it quickly. Apart from the ability to display 16.8 million colours, this new model is identical

to the Proteus Core, with a 12,000dpi optical sensor, 11 programmable buttons, and the ability to save profiles to the mouse.

One of our favorite features is the clutch button that disengages the wheel's notches, allowing it to spin freely — and it goes on spinning for some time after you remove your finger, a benefit of the metal rim. If there's a downside, it's that the lighting doesn't feel like an upgrade — we'd have liked to see a newer sensor module or some refinement of the switches under the buttons. But when your product is this good, we understand Logitech's desire to stick with a proven formula.

Verdict

Solid build and performance; highly customisable.





\$99 | MIONIX.NET

Mionix Castor

A black mouse that's classy and understated.

What at first looks like it's going to be an ambidextrous mouse turns out to be nothing of the sort. This is a right-handed-only zone, with its ergonomics subtly tuned to support only the ruling class in our unequal society.

The Castor is one of the smaller models in our roundup. It wants to position itself as a premium product, and almost succeeds. The sensor is a 10,000dpi PMW-3310 optical unit that boasts a complete lack of hardware acceleration. There are six fully programmable buttons and the shape supports all types of grips.

Matte black mice always look good. Its four-layer rubber coating means it's not going to easily slip out of your hand, and the lighting effects have the standard range of solid, blinking, breathing and pulsating settings. There are no additional weights to change the mass of the

mouse, which is nicely balanced straight out of the box.

The result of this is that the Castor has become a bit forgettable. The build quality is excellent, the sensor unimpeachable, the software comprehensive and the ergonomics extremely comfortable.

It would be wrong to call such a mouse boring, because so much of the fluff manufacturers add to their latest models in order to make them stand out from the pack ends up looking ridiculous.

Perhaps we're just not used to this level of quality from something not festooned with flashing lights and strangely angled surfaces after all.

Verdict

No hardware acceleration; excellent build quality.



\$119 | WWW.RAZERZONE.COM

Razer Diamondback Chroma

The thin-bodied mouse returns to rattle us.

This claims to have the first 'optical gaming sensor' – although what marks out a sensor as being for gaming we're not sure.

The slim, tapering shape is unusual; your right thumb tucks right into the side but your fingers are left without enough to get a proper hold. It can sit forward in your grip; it's not uncomfortable, even if it's a bit low for our tastes, but after years of increasing girth, it takes a little getting used to. The 2016 Diamondback feels less flat than the original, and this improves the comfort.

The lighting, which occupies a continuous thin strip around the body of the mouse and the wheel, isn't too horrifying, even though it's set by default to coruscate through its entire spectrum in a way that'll at first fascinate you before boring you to death.

It would be even nicer without the ridiculous three-headed logo that also flashes, but at least that's

covered by your hand. It's also available as a truly ridiculous Collector's Edition. Does anyone collect mice? Maybe keep them in a glass case and show them proudly to visitors? If you do, write in.

The original model was released in 2004, a more civilised time before coloured lights were common and marketing philistines crammed our nimble pointing devices full of unnecessary gubbins. This new model has thoughtfully updated the original, with a 16,000dpi sensor and access to Razer's latest software. It's not a mouse everyone will be comfortable using, though – the epitome of 'try before you buy' – and it feels a little basic for the price.

Verdict

Updated classic; high-resolution sensor.





\$109 | WWW.RAZERZONE.COM

Razer Mamba TE Chroma

A comfy device, with lots to recommend it.

There are two versions of this mouse. The Luxury Edition doubles the price and adds optional wirelessness, customizable click force through a couple of hex nuts on its base, and comes with a recharging stand that lights up. Nnngh!

The Tournament Edition is the basic model, and the more successful of the two. It's a large mouse that fits well in the hand, with a humped back to increase comfort. Like every other mouse in this test, it's permanently wired to your PC. There's a lighting strip that, by default, slowly cycles through its colours. The large Razer logo also lights up – a feature the Luxury Edition lacks – and if you've got a full house of Razer products on your desk, you can synchronise the lighting across headset, keyboard and mouse using the Razer software.

The Mamba is lovely, a really nice mouse to use all day. So nice that we'd call

the Luxury Edition unnecessary. It's not overburdened with switches, with only two extra buttons either side, and no way of making it ambidextrous, but the wheel clicks left and right, and rolls satisfyingly under the middle finger, with big notches so you know when it's clicked into place.

It's a bit back-heavy, but the rubberised area below the side buttons is a good thumb rest, allowing a decent grip, no matter what hand position you prefer.

The sensor is a 16,000dpi laser unit, all nine buttons can be reconfigured, and the seven-foot cable feels generous.

The Mamba is a great all-round package that does everything it sets out to do.

Verdict

Comfortable, grippy, precise.



\$89 | WWW.RAZERZONE.COM

Razer Naga MMO

Razer peppers the MMO mouse with buttons.

With a laser sensor and 19 programmable buttons, the Naga Chroma is trying very hard to get some attention, and it will probably succeed by big numbers alone.

As an MMO mouse, the Naga falls into the same traps as the Corsair Scimitar, although it makes its buttons easier to locate by providing them with a concave top surface, so there's less chance of pressing two at once. If you have to look at it, Razer has chosen to rotate the numbers printed on the array through 90 degrees, presumably to make them easier to read, although we're not sure about that, having tried it. The wheel is a tilting model that moves very positively, its rubber tyre nicely studded to prevent slippage.

The ergonomic design makes it feel a little smaller than the Scimitar, although it still has to integrate the button array into its structure, so any space

savings Razer has achieved are going to be minimal. The black plastic shell is grippy and ever-so-slightly textured.

A finger rest on the right side is a nice touch, giving those underused digits somewhere to hang out.

This version of the Naga ups the colours it's capable of displaying to 16.8 million, and also comes in a left-handed version. A wireless edition, the Epic Naga, is also available.

You have to love MMOs (or possibly accounting) to buy a mouse like this, and the Synapse software makes configuring its button array very straightforward. Its appeal may not be broad, but if you have a need for all those buttons, you won't be disappointed with the Naga.

Verdict

Good sensor; lots of buttons; nice wheel.





\$72 | WWW.ROCCAT.ORG

Roccat Kiro

Perfect for lefties on a budget.

The Kiro is a mouse you can use with either hand. We already have a perfectly good word for such a thing, but Roccat has decided to invent its own: 'superdextrous'.

You get four 'sides' in the box, two with buttons and two without, enabling you to place additional switches (all Omrons) where you need them the most. They're attached by magnets and snap into place. Claw grippers will be able to use all four extra buttons, while palmists will prefer to have one set, easily reachable with the thumb or by curling back a finger, if you're into hand yoga.

The body is heavy, with no way of removing any weight, and features a soft-touch coating. The lighting is subtle, being limited to the logo on the back, and is controllable from the setup app. The sensor is a 2,000dpi optical model, which can be doubled in software. The results aren't great, however, and we don't

recommend doing that unless you absolutely must.

This is another budget mouse, and wins over the Rival (right) in terms of its 'superdextrous' customisability. Left-handers will certainly appreciate this, and the additional weight of the Kiro will raise it up in the opinion of others. But the weight is positioned toward the back of the mouse, throwing off its balance somewhat.

The buttons are responsive, and custom assignment through the Swarm software is simple.

A good choice for anyone looking to spend less than \$75, offering additional features at the cost of some clunky design.

Verdict

Ambidextrous; reasonable price; replaceable magnetic sides.



\$49 | STEELSERIES.COM

SteelSeries Rival 100

Not a broad mouse, but it has broad appeal.

This is a good basic mouse, with only two additional buttons, and a sensitivity switch on top. With a smooth matte plain black finish, it fits well in our palm — although claw grippers will get on well with it too — and the programmable lighting is kept to just the wheel and the logo on the rear.

There's a lot to like about this budget offering but it doesn't feel like it's built to a budget. There's a good rubbery grip at the side, bobbled for extra pleasure, and it's light, although with no option to increase the weight. The shape is ambidextrous, but there are only buttons on the left-hand side, catering to the righties. The buttons have new switches, and are lighter and easier to press than the original Rival.

The wheel rotates much as you'd expect, with no clicking left and right. It feels a little less solid than on pricier models, but still works perfectly in general

use. There's a hint of the Microsoft mouse about the body, and it's likely to appeal to a broad range of users.

Underneath, SteelSeries has splashed out on a home-grown optical sensor and it performs well. The maximum resolution is 2,000dpi, but this can be doubled in software. Just like using the digital zoom on your cellphone camera, though, noise creeps in and the quality is degraded, so we still don't recommend doing this.

Overall, this is a great budget offering. It may not have the extras that other devices in this test have, but it also doesn't suffer from their price tags. It's hard to go wrong with something this well made for this kind of price.

Verdict

Great budget mouse; no hardware acceleration; broad appeal.



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Ubuntu 16.04: your next OS?

As the Ubuntu release bandwagon rolls into town, Mayank Sharma helps you look past the fanfare and decide whether you should take the plunge.



Every six months, the Ubuntu developers and ardent community of users and fans celebrate the arrival of a new release with almost religious fervour. The hoopla around the Ubuntu 16.04 LTS release is no different, except for the fact that this one ushers in enough changes to actually do justice to the adulation.

The Ubuntu distribution (distro) is at the cusp of introducing a major overhaul with lots of changes to the back-end infrastructure that will have

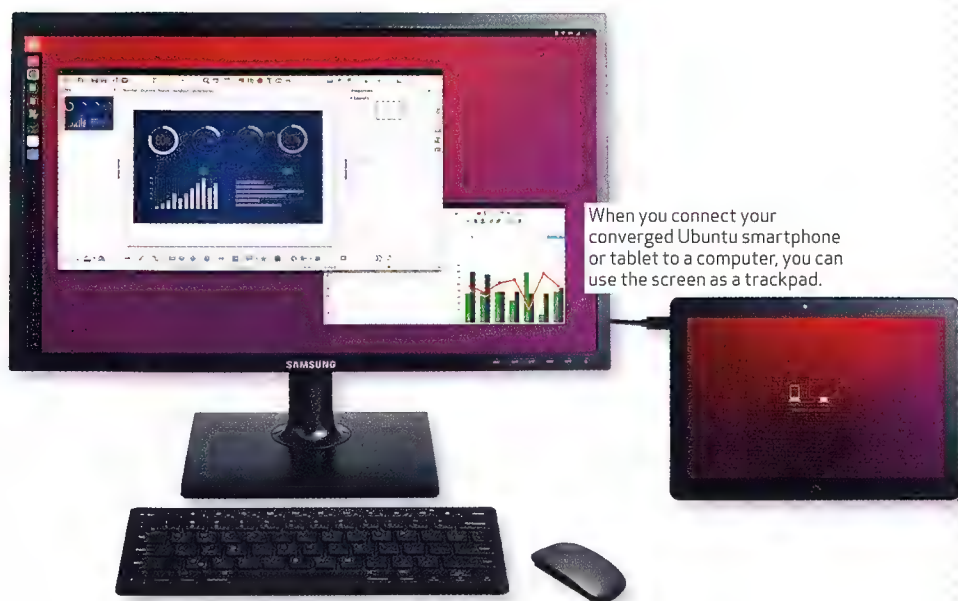
a direct bearing on the rendition of the desktop. The primary thrust behind the makeover is Canonical's aspirations to take the project beyond the confines of the desktop. If you recall the 'successful failure' of the Ubuntu Edge Kickstarter campaign – which demonstrated that Canonical had been toying with the idea for several years – well, it finally came to fruition with the launch of Ubuntu-powered phones in 2015.

While the jury is out on whether the Meizu MX4 and the BQ Aquaris

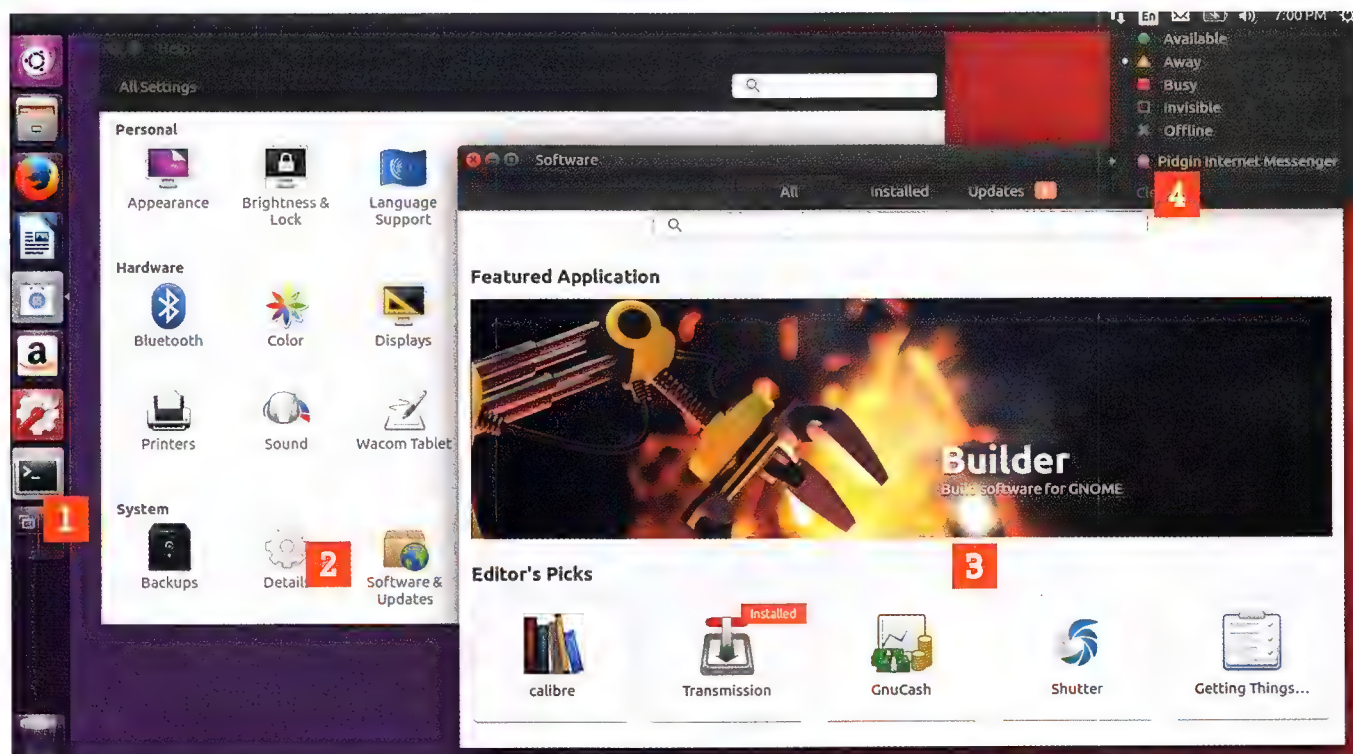
smartphones managed to impress the non-Ubuntu users, the upcoming line-up of Ubuntu-powered devices – starting with the BQ Aquaris M10 tablet – have the potential to attract people unfamiliar with open-source software. In addition to its innovative user interface, the tablet's most impressive functionality is its convergence feature, which allows the tablet to transform itself into a full-fledged desktop operating system as soon as you plug in a keyboard and mice.

CONVERGENCE

As Ubuntu expands its mandate beyond the desktop to encompass other devices and form-factors, so does its internal machinery. The upcoming release of the Unity 8/Mir display server will be a critical component in the standardised new code base that will be used on both the regular Ubuntu desktop, as well as other Ubuntu-powered devices. Owing to these changes, Ubuntu 16.04 – dubbed Xenial Xerus – is probably the last release of the desktop as we know it. The LTS nature of the release means that it will be supported long after the desktop rejuvenates itself and inadvertently (and invariably) manages to offend a section of the community. While the project rides through the upcoming wave of uncertainty, you can bet on this release to keep you afloat.



Navigating the interface



1 THE LAUNCHER You can use the Launcher to begin exploring the distro. The first icon on the launcher brings up the Dash that displays a list of applications and other information depending on the enabled scopes and lenses. You can pin your favourite applications to the launcher.

2 SYSTEM SETTINGS You can configure all aspects of the Ubuntu 16.04 LTS desktop environment from this System Settings window. Use the gears-and-spanner icon pinned to the Launcher to bring it up. The window is logically arranged and is fairly intuitive to navigate and use.

3 GNOME SOFTWARE Starting with Ubuntu 16.04 LTS, the distro will use the Gnome Software package manager. You can use the manager to search for and install any applications from the Ubuntu repositories (repos). Like all good app stores, Gnome Software lets you rate and review apps.

4 MESSAGING MENU If you have installed an instant messenger such as *Pidgin*, you can use the envelope icon in the menu bar to bring up the messaging menu. This menu helps you keep track of all your IM accounts and allows you to change your availability across them.

New and noteworthy

A look at some of the best features of the new release.

An Ubuntu LTS release is always a special affair. The primary goal of the Ubuntu developers is to provide a stable platform that can run reliably for the duration of the extended support cycle. On top of it, they must also take into account future developments in the larger open-source software ecosystem that might have a direct bearing on their support infrastructure. For instance, Ubuntu 16.04 doesn't support AMD's proprietary fglrx drivers any more, as AMD has announced plans to wean users away from its proprietary fglrx driver to the open source amdgpu drivers.

LAST THE TERM

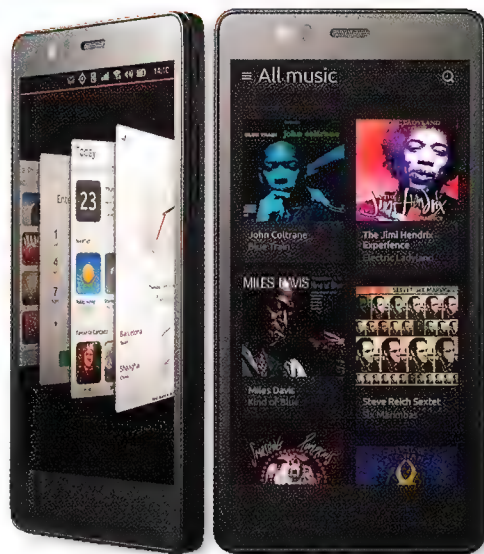
Ubuntu 16.04 is a Long Term Support (LTS) release that will be supported until 2021. Unlike traditional Ubuntu releases, LTS releases come out every two years and continue to receive updates for the next five years. The LTS releases are prepared with more care than regular releases and only include components that have been well tested by the Ubuntu developers or the larger community of Linux distros. The regular Ubuntu releases have already switched to the Systemd service manager and 16.04 will be the first LTS release to do so as well.

The distro is powered by Linux kernel 4.4, which is also an LTS release that will be supported for the next two years. This kernel makes significant strides to supporting Intel's new

Skylake family of processors, as well as for ARM's 64-bit processors. Thanks to the addition of 3D support in the kernel's virtual GPU driver that enables virtualisation guests to use the host graphics card efficiently, you'll be able to run graphics-intensive applications inside a virtualised Ubuntu 16.04 installation as well.

Talking of graphics drivers, as mentioned earlier, the fglrx driver is now deprecated in the 16.04 release. The developers have backported code from Linux kernel 4.5 to provide a better experience using the much improved open-source alternatives, namely radeon and amdgpu. If you use AMD graphics cards, note that not only will the upgrade process remove the proprietary drivers, you'll also not be able to manually install them after moving to Ubuntu 16.04. This is because the distro ships with Xorg 1.18, which doesn't support the AMD proprietary drivers.

Another feature in the 4.4 kernel that may have a significant effect during 16.04's support cycle is the kernel's ability to deliver updates through a standardised procedure. Coupled with Gnome's (currently under-development) fwupd tool, you could update your BIOS/UEFI firmware easily using Ubuntu's package management tools.

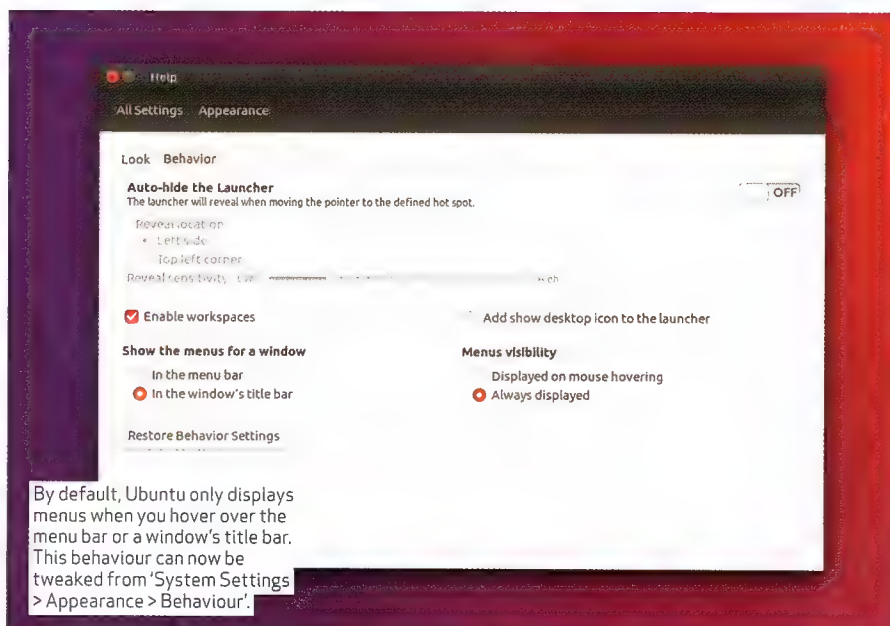


SOLID FOUNDATIONS

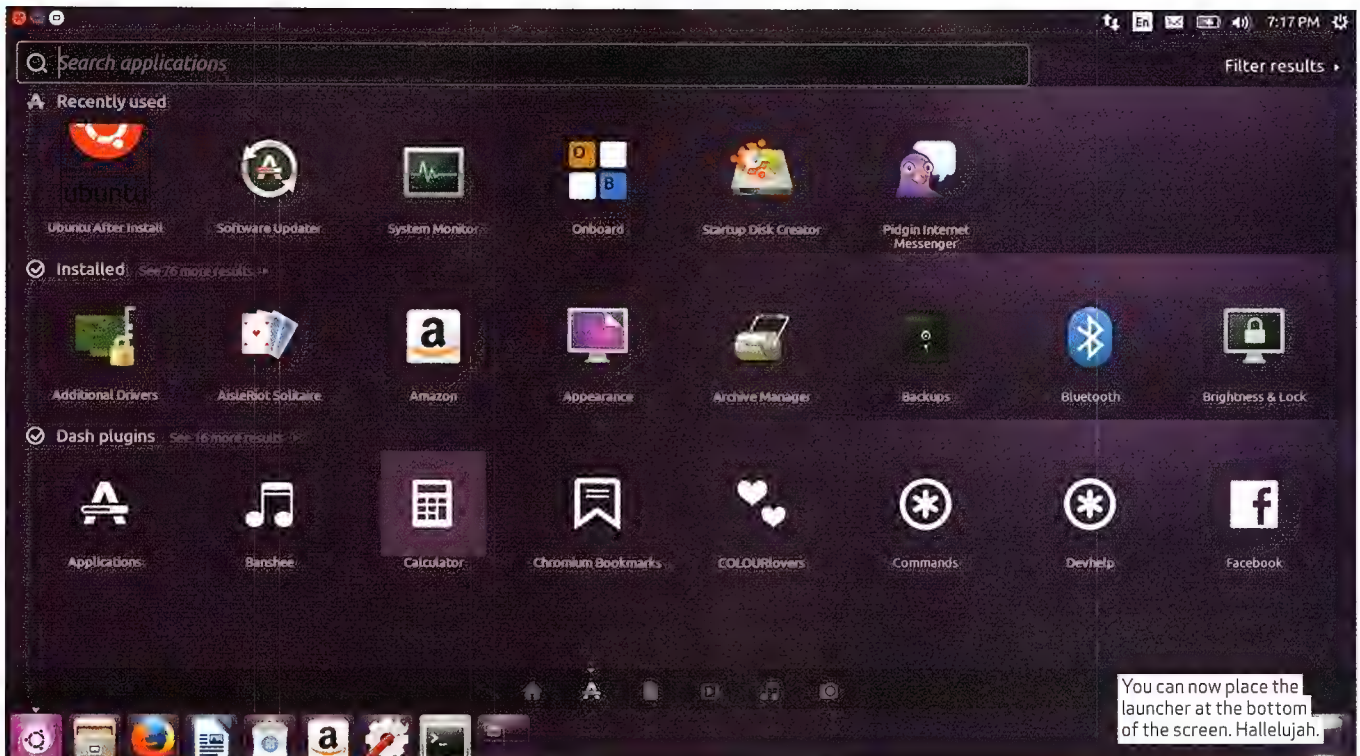
One of the major additions in Xenial is support for the ZFS filesystem. The filesystem was available as a technology preview in the last Ubuntu 15.10 release. However, starting with 16.04, the filesystem is supported officially by an OpenZFS-based implementation (which will be controversial in some quarters due to licensing issues). The ZFS filesystem is a popular and much sought-after filesystem by system admins for implementation in situations where data integrity and resilience are paramount. The file system is the default on distros used for building data silos such as FreeNAS. While ext4 remains the default file system of the distro, Canonical is hailing ZFS and the file system for hosting containers in Ubuntu 16.04, thanks to its data-crunching features.

On the desktop side of things, Ubuntu 16.04 ships with the Unity 7.4 desktop environment, as the new Unity 8 isn't quite ready yet. While the overall look for the Unity interface hasn't changed much between the previous releases and Xenial, the desktop has had numerous minute improvements that help make it rock solid and very usable.

The Unity desktop now adds session shortcuts for logout, restart and shutdown options in the Unity Dash which also features new scroll bars. There are several other small usability improvements as well, such as the icons for the external storage and Trash windows will indicate the



By default, Ubuntu only displays menus when you hover over the menu bar or a window's title bar. This behaviour can now be tweaked from 'System Settings > Appearance > Behaviour'.



number of open windows just like any other icon on the Launcher.

Furthermore, Unity will no longer wait for a resource-intensive application to load completely before it places an icon in the Launcher. If you use multiple workspaces and enable the workspace switcher, you can now right-click on it to access a new quicklist menu. The quicklist options for removable drives now sports the

option to format the device. Also, if you have a microphone connected, you can use the sound menu to adjust its input volume with a slider.

After repeated requests from the users, the previous version of Unity allowed users to show the menus for the windows in the window's title bar instead of the menu bar. In Unity 7.4, users can choose to display this menu automatically instead of the earlier

option that displayed the menu only when you hovered the mouse over the designated area.

There's further evidence of the Ubuntu developers paying heed to their user's feedback (read: criticism). The project has received much flak from its users for including the Amazon scope which passed all user queries from the Dash to the ecommerce website to bring up

Experience Unity 8

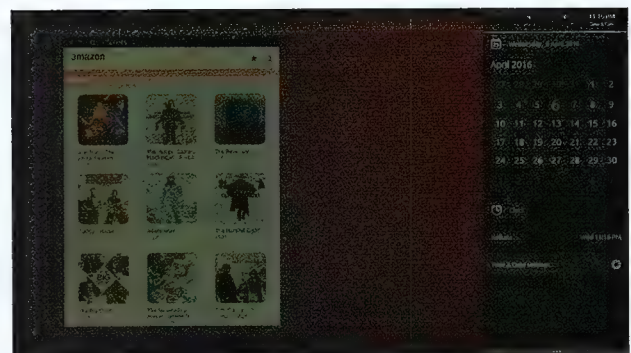
While Ubuntu 16.04 ships with an updated Unity 7 desktop environment, everyone's keeping their eyes peeled for Unity 8. This upcoming desktop environment is key to Canonical's convergence experience and is based on top of Qt5/QML unlike the previous versions, which were written in Ubuntu's own custom OpenGL-based toolkit called Nux.

The developers attribute this change to the positive experience with Qt5/QML while working on the Ubuntu Touch project. The other major change is the use of a totally new display server as well. To achieve the user experience they want, the developers will implement Unity 8 on top of the Mir display server instead of the traditional X window server system.

On the visual side of things, the Unity 8 user experience won't be all that different from the current Unity 7, but you can be sure of noticeable visual differences. In the scheme of things, Unity will still be a shell, with all its hallmark components including a launcher, the indicators and the Dash. But these will be enhanced and styled with improvements garnered from the Ubuntu Touch project.

Work on Unity 8 is nearing completion but the desktop is still currently under active development and isn't quite ready for the mainstream. However, here's a simple and safe way to experience the upcoming desktop on top of Xenial brought

to you by the miracles of Linux Containers. Fire up a terminal window and type `sudo apt install unity8-lxc`. When it's downloaded and installed, configure the container with `sudo unity8-lxf-setup`. This command will take some time to complete as it configures the containers and downloads and installs the Unity8 meta-package, apps and relevant dependencies. When it's done, reboot your computer and then select the Unity 8 sessions from the login screen to experience Ubuntu's new desktop.



relevant results besides the applications and documents you were looking for. Ubuntu had earlier implemented a kill switch to disable this much panned privacy-invading feature and has now finally decided to disable it by default in the latest release.

Another change that took over six years to implement, and is a major departure from Ubuntu's adamant position of governing the usability of the Unity desktop, is the option to move the Unity launcher to the bottom of the screen. This placement will be default on Ubuntu Kylin (the official Chinese rendition of the distro) who did all the heavy lifting to implement this feature. To move the Launcher on the main Ubuntu release, install the `dconf-editor` and navigate to `'canonical > unity > launcher > launcher-position'`.

Talking of fixing long-standing issues, the onscreen keyboard in Ubuntu brings up a virtual keyboard that floats around the desktop. That's changed in Ubuntu 16.04 with the developers making the application pin a keyboard across the full-width at the bottom of the desktop. This implementation now looks more polished, refined and consistent.

APPLICATION SWAP

The one thing that has been quite consistent between Ubuntu releases is its default set of applications. The distro has been quite usable straight out of the box and the developers haven't heard enough noise from

the community to alter its winning combination.

While Ubuntu ships with some of the best and widely used open-source applications that are maintained and updated regularly, two haven't received developer attention for quite a while: Empathy and Brasero. Both of these applications have been zapped from the official ISO image of the distro. Still, while they are no longer available in the default installation, you can easily fetch them from the official repos.

Of the two, Empathy was pivotal to one of Unity's key components: the messaging menu. With Empathy no longer installed, the icon for the feature is missing from the top-right corner of the menu bar. Also, the Online Accounts feature will no longer allow you to add accounts on instant messaging services and XMPP servers. However, you can bring back the messaging menu by installing either Empathy or the much more actively maintained instant messaging application, Pidgin, which ships with the Unity Integration plugin enabled by default to hook up with the desktop environment.

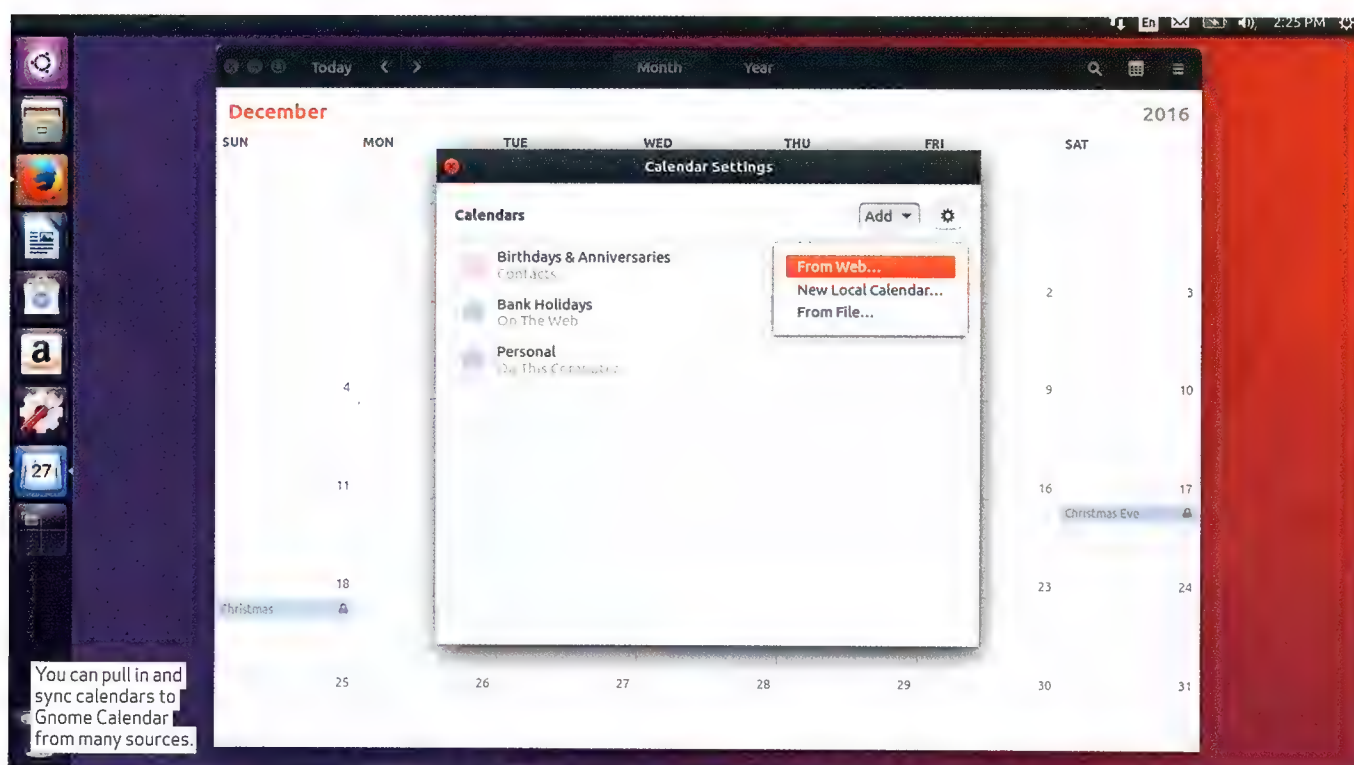
The one major application to be dropped from Xenial's arsenal is Ubuntu's marquee Software Center. Like the other applications, it too didn't receive much love from its developers (Canonical itself) besides the one-off patch for fixing vulnerabilities. This, coupled with rumours of a new improved software centre for Unity 8, led the Ubuntu Mate spin to drop the Ubuntu Software Center from its

distro. With the 16.04 release, Canonical has validated the move by dropping it from the main release as well. Instead, the distro has switched to the actively maintained Gnome Software which is steadily picking up new features.

In more packaging related news, the Ubuntu developers have also reworked the mechanism for labelling dependencies behind the scenes. Several dependencies have been moved to the 'recommends' section instead of their original 'requires' position. The result of this change is that you'll be able to remove particular applications from your installation without breaking the desktop; for example, you'll be able to remove LibreOffice without removing the Ubuntu Meta package along with it as well. The change is meant to allow users more control over what packages are on their desktop.

Another application that Ubuntu has picked up from the Gnome project is Gnome Calendar which is more feature-rich and integrates well with the Ubuntu desktop. Gnome's calendar app was chosen over Ubuntu's because it strikes the right balance between offering more features and usability; for example, the application can visualise your upcoming events in several different ways and enables you to search the calendar.

Phew, that's quite a lot of changes for an LTS release. If you were waiting for the right release to plunge into Ubuntu, this is it. Grab the 64-bit Desktop version at releases.ubuntu.com/16.04/ and drape your computer in the Ubuntu (purplish) orange.



You can pull in and sync calendars to Gnome Calendar from many sources.

Post-install tweaks

Polish your freshly minted installation for maximum mileage.

FETCH UPDATES

The Ubuntu installer offers a checkbox to install updates during installation. Even if you toggle the checkbox, still one of the first things you should do on a pristine installation is to check for available updates. Open the dash, search for updates, and click the Software Updater launcher. Once it has scanned the Ubuntu repos for available updates, click the 'Install Now' button to install any updates that are available.

ENABLE THE FIREWALL

A firewall helps insulate your computer from malicious users looking for ways to gain access to your system. Linux includes the comprehensive iptables firewall which can be easily managed with the Gufw application. It's available in Ubuntu's Universe repos and can be installed with `sudo apt-get install gufw`. Once installed, bring up the System Settings window and click the 'Firewall Configuration' option under the System section. Begin by first enabling the firewall.

Once enabled, you can set the incoming and outgoing policies by selecting one of the three options in the drop-down menus. The Allow option will allow traffic without asking any questions. The Deny option will silently discard all incoming or outgoing packets. The Reject option is different in that it sends an error packet to the sender of the incoming packets. After you've set the policy for traffic you can define specific rules for individual apps and services. To create a rule, switch to the Rules tab and click on the '+' button. Use the Preconfigured tab to select the application and the Gufw will define the most effective rules.

INSTALL PROPRIETARY DRIVERS

Despite the improving quality of free software drivers, some of your computer's hardware can only be used to its full extent via proprietary drivers. This is particularly true for gaming with the latest generation of graphics cards. By default, Ubuntu only ships with and uses open source drivers, but you can install proprietary ones with ease. Head to the Dash, type software and select the open the Software & Updates tool. Then switch to the Additional Drivers tab, which will scan your computer and list the

drivers that best suits your proprietary hardware.

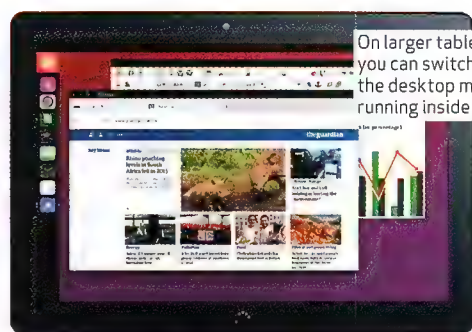
CONFIGURE BACKUPS

Ubuntu ships with one of the simplest to use backup tools called Déja Dup. The application has a very minimal interface but you'll need to configure it before putting it into action. Bring up the System Settings window and click the 'Backups' option under the System section to launch Déja Dup. In the application, switch to the Folders to Save tab and use the '+' button at the bottom to point the application to the folder you wish to save. After you've selected the folders to backup, switch to the Storage location tab to point the tool to the location where you want to house your backups.

Déja Dup can save backups on a separate partition or on a remote location accessible via SSH, FTP, Samba or WebDAV. While creating a backup, Déja Dup will also, optionally, allow you to encrypt backups. Creating the initial backup usually takes quite some time, but subsequent backups are much faster because the tool only backs up data that has changed.

INSTALL ESSENTIAL APPLICATIONS

While Ubuntu ships with all the package management tools at your disposal, you can save yourself some time and use the 'Ubuntu After Install' (UAI) application to do the heavy lifting for you. This can install dozens of essential applications in a single click. Some applications that it can install are not available in the Ubuntu



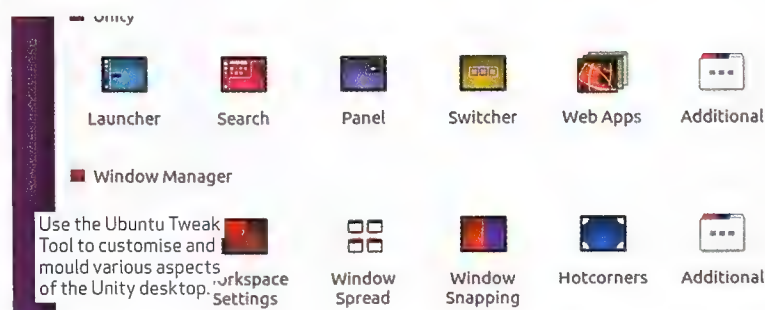
On larger tablet displays, you can switch the view to the desktop mode with apps running inside window.



repos and require the addition of a PPA. Here too UAI can save you some time and effort and install the PPAs automatically. To use UAI, scroll down its homepage (bit.ly/UAIHowTo) and install the Deb using Gnome Software. Once installed, launch the application from the Dash and select the ones you wish to install before hitting the 'Install Now' button.

SETUP ONLINE ACCOUNTS

Ubuntu can pull in content from several popular (albeit mostly proprietary) services right into your desktop. To get started, bring up the System Settings by clicking on the gears icon in the top-right corner of the screen and head to the Online Accounts option. Use the interface to add your accounts on any of the supported services. After you've added an account, Ubuntu enables you to search for content on these online services from the Dash. You'll also be able to publish content from the associated application as well; for example, you can post photos from Shotwell directly to a Flickr album.



The converged future

Warning: lanes are merging ahead.

Ever since the Ubuntu Edge campaign, Canonical has been teasing users with the concept of convergence — a true all-in-one device that can be used as a phone, a tablet or a full-fledged PC. We've been kept on tenterhooks ever since the campaign failed to reach its lofty crowdfunding target. The device that almost became a reality in 2013 has traversed the distance from the drawing board to the shelf. It's the natural evolution of the smartphone and has put Ubuntu and Canonical at the forefront of the reimagined personal mobile computing experience wave.

It took this long because Canonical set up some lofty goals for itself. For a smartphone that can double up as a PC, the company wanted an OS that could give users the same experience from a smartphone as from a PC. This meant rewriting some of the critical components that contributed towards making the desktop. Unity 8 is the first piece of the convergence puzzle.

Ubuntu's new user interface and display framework is tasked to run across all Ubuntu devices in order to power them all by the same codebase. Put simply, Unity 8's objective is to run as the display mechanism across the entire range of Ubuntu offerings.

The developers at Canonical also extended the advantages of a common, fully contained codebase to the packaging system as well. Speaking at Mobile World Congress (bit.ly/ShuttleworthAtMWC2016) in Barcelona, Spain earlier this year, Mark Shuttleworth — Canonical's Gandalf-like leader — mentioned that the company realised: "For the [Ubuntu] phone, we knew we needed to create a new kind of packaging system that had a much more reliable upgrade and rollback mechanism and was much easier for developers to simplify all of the packaging." Shuttleworth said this work evolved from the click packages used in the phone to Snappy, first used in 15.04, and Snappy 3.0 which will make its way into Ubuntu 16.04.

ALL FOR ONE AND ONE FOR ALL

Ubuntu made its smartphone debut with a bunch of devices in 2015. They were quickly lapped up from online stores in Europe and Asia, and at the MWC earlier this year, the company took everyone by surprise by demoing the first fully converged Ubuntu Edition of the BQ Aquaris M10 tablet.

The device, which is now available for order, features a dynamically adaptive user interface that provides both a tablet experience and the full

Ubuntu desktop experience. Not surprisingly, the tablet and Ubuntu's convergence experience won several accolades at the show, including Tom's Hardware 'Best surprise of MWC' and was dubbed the 'Best of MWC 2016' by Trusted Reviews.

The Ubuntu devices can be operated by gestures alone. Swiping in from the left brings up the familiar Unity Launcher and the same action from the right brings up various scopes. On the mobile devices, the scopes act like individual home screens for different kinds of content such as movies, music and social media, without having to launch individual apps.

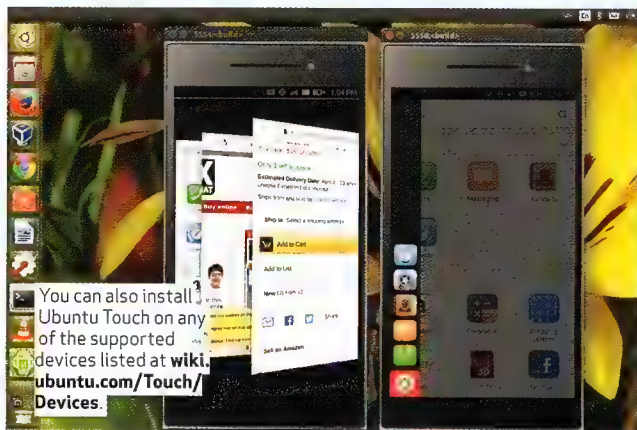
The real magic happens when you hook up the tablet to a monitor and traditional input devices. The interface now renders as it would on a regular desktop Ubuntu installation. Full-screen windows are placed inside windowed ones with the usual controls in the top-left corner. One of the best things about Ubuntu's convergence experience is that it preserves the state when you switch between the device and desktop and back.

So if you are halfway through filling out a form or editing a document on the tablet, you can continue doing it as soon as you switch to the desktop mode.

Experience Ubuntu Touch

If you wish to experience the Ubuntu Phone without actually owning one, you can use the emulator that's designed for developers to play around with the device. The Ubuntu Touch emulator is a neat little piece of software with modest requirements. Just make sure you run it on top of an Ubuntu release that is no older than 14.04. It'll take up 512MB of RAM by default, although you can earmark more for a smoother experience. To install the emulator, fire up a terminal and type `sudo apt-get install ubuntu-emulator`. When it's fetched and installed the basic components, type `sudo ubuntu-emulator create myubuntuphone --arch=i386`. The command will take some time to complete as it downloads the required components. You can replace "myubuntuphone" with any name you like. This is the name of the instance and the emulator allows developers to create multiple instances for different purposes. The `--arch=i386` switch will ask the emulator to use the i386 architecture for faster performance instead of the default armhf architecture. When the emulator has created the instance, you can run it with the `ubuntu-emulator run myubuntuphone --scale=0.7 --memory=1024`

command. The `--scale=0.7` scales down the virtual phone's UI to 70% of the original size. You can drop this option on displays with full HD resolutions. The `--memory=1024` options gives the emulator 1GB of RAM.

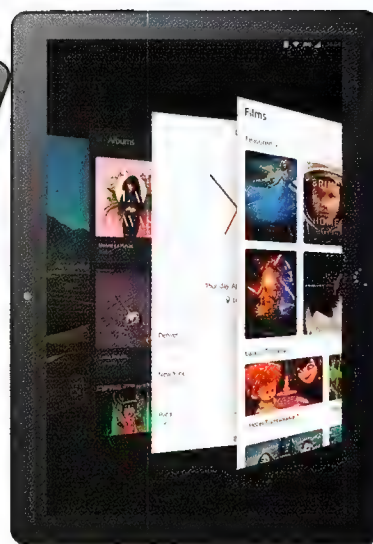
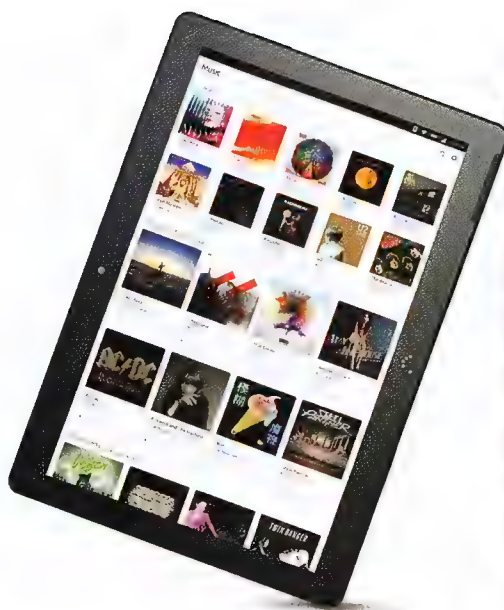


Ubuntu's convergence isn't just about the uniformity of the interface, but also about the unity of the underlying infrastructure for the developers. Having a single, visual framework and the same set of tools for applications to run on any type of Ubuntu device, means that applications developed for mobile will scale and run on a desktop display.

"Our SDK will provide tools for developers of mobile applications to build desktop contexts for these apps," writes Richard Collins, Canonical's Head of Devices on the company's blog (bit.ly/PathToConvergence). "Similarly, developers of desktop applications can use our SDK to extend and enhance their application for mobile use. Convergence brings a whole new set of contexts for developers and our SDK will provide the fundamental tools developers need to make their apps easy to adapt and run on any display."

Collins further explains that it's the same exact code powering the application whether it's running on a phone or on the desktop. This allows third-party developers to create applications which will automatically be available across all devices and form-factors. This is possible because Ubuntu doesn't need to know if the application is coded for a mobile or desktop display, but leaves it to the application to pick a suitable interface depending on the available display device.

While the BQ Aquaris tablet is currently the only device that ships with a true convergence experience, the feature isn't just limited to that one device. In an email exchange with APC, Collins told us that convergence is a chipset dependency and requires the chipset supplier to enable video support for the USB Type-C component on the Board Support Package: "We expect chipset manufacturers to fully enable USB-C type functionality for future boards. At the moment there



are not very many chipset products with full video support."

CONVERGENCE ON OTHER DEVICES

What this means is that Canonical's latest handset, the Meizu Pro 5 doesn't support convergence. However, Collins added that the company has already shown phones as old as the Nexus 4 supporting convergence at events, so it's certainly something you can expect to see in future.

In its bid to perfect and deliver the convergence experience to a whole lot of devices, Collins shared that Canonical is evaluating alternative technologies that they expect to turn into products in the near future: "One of the primary candidates we are working on is a Wi-Fi direct solution using specific code developed by us to deliver exceptional responsiveness over wireless."

Ubuntu's convergence sounds fantastic, especially to the tired arms sore from lugging around a laptop.

The BQ Aquaris M10 tablet will surely be of tremendous use to the millennial road warriors who can get through a productive workday without much processing power. Those of us that need to process large amounts of data to run virtual machines or compile kernels, will probably have to wait a little longer.

Hearing Shuttleworth talk at the MWC leaves us feeling optimistic. "We are celebrating the success of Linux but we also know that we have to evolve. And with personal computing ... we are really trying to put free software right at the front of what personal computing could be. We know there are some people that might say, 'Why do you bother with something that's only 1% of the world?' But 1% of the world is enough to change the world. I want to make sure that we have a highly secure, all-free software platform that can be anything that people need it to be."

New and old flavours

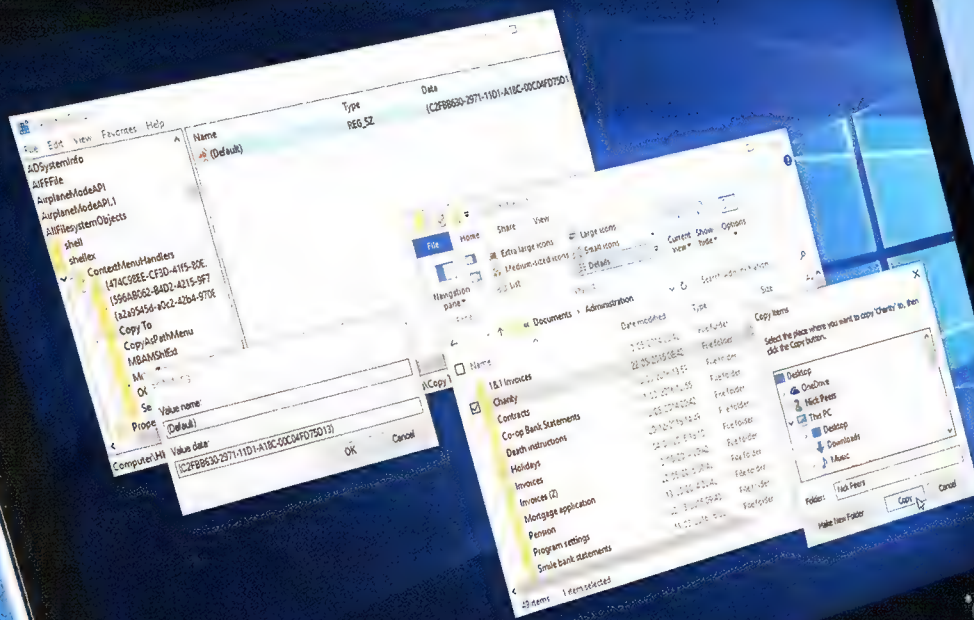
Besides the main Ubuntu release, several official Ubuntu spins have also taken part in the 16.04 LTS release cycle and put out new versions of their respective distros. Kubuntu 16.04 will be the first LTS release based on the new but now stable Plasma 5.5 desktop. It couples this with applications from KDE Apps 15.12 along with LibreOffice 5.1 and Firefox 45.

Gnome users can experience Gnome 3.18 with Ubuntu Gnome 16.04 LTS. The distro also allows users to test drive the upcoming Wayland display server by installing the gnome-session-wayland package and then selecting 'Gnome on Wayland' from the login screen.

The Ubuntu Mate distro makes its LTS debut with a variety of minute changes to improve performance and stability.

The Synapse launcher is now fully integrated with the Mate desktop and can be enabled with the Mate Tweak app. Similarly, the Mate Compiz integration has also been improved for a smoother experience.

Lubuntu 16.04 LTS will again push out what is primarily a bug fix release as they continue work on an LXQt-based release. Similarly, the biggest change in Xubuntu 16.04 LTS is the absence of a default media player. Besides these specialised Ubuntu releases like Mythbuntu, Ubuntu Kylin and Ubuntu Studio have also released LTS tagged versions. However the Edubuntu project is going through a midlife crisis and instead of a 16.04 LTS release, its developers plan on supporting the 14.04 release until 2019. ■



MASTER THE WINDOWS 10 REGISTRY

Tweak your PC with the help
of Regedit and Nick Peers.

The Registry has been a vital component of Windows for the last 20-odd years. It's a central database, where all kinds of settings and preferences are stored, and not just by Windows, either. The vast majority of applications installed on your PC store their own data in the Registry, too, as do many hardware devices.

In this feature, we'll examine how the Registry is constructed, plus reveal how you can access its data – not just to view its contents, but also to tweak settings. Why do this? It all boils down to personal preference, and the fact that Windows is built with a wide range of hardware in mind, so many settings are configured to just work, rather than push your PC's performance, or give you granular control over various aspects of how it works.

The Registry is also a useful beast for those unhappy with how Windows 10 looks and operates – that's because lurking behind some of the less appealing parts of the new user interface are settings you can tweak that restore classic functionality. We'll examine some of these tweaks in this feature. We'll also reveal a number of tweaks that may help you boost your gaming performance, too, plus how you can use the Registry to tweak various security and privacy settings that are normally reserved for Windows 10 Professional users.

All of this sounds frightfully (or delightfully) meddlesome, so it's a good idea to back up your Registry before you start to mess around – we'll reveal what you need to do (plus how to restore your backup if things go wrong). Finally, jumping around different parts of the Registry can be time-consuming, so we'll reveal how you can quickly build scripts using Notepad to change multiple parts of the Registry with relative ease.

"All of this sounds frightfully (or delightfully) meddlesome, so it's a good idea to back up your Registry before you start to mess around."

Let's open with a bit of Registry 101. The Registry is made up of a group of files called 'hives', which are stored in two separate folders on your hard drive – 'Windows > System32 > Config' for system-wide settings, and your personal User folder for settings associated specifically with your user account.

Each hive consists of a different set of preferences and configuration data – for example, the system-wide software settings are stored in a file called SOFTWARE. This information is organised into sub-folders known as 'keys'. Each key contains one or more 'values' with their associated 'value data', which are the actual configuration settings for your PC.

There are numerous types of value, depending on the data they contain. The most common include REG_DWORD values, which contain binary or hexadecimal numbers in 32-bit format (the 64-bit equivalent is REG_QWORD), and REG_SZ, which contains text-like drive labels, context menu options, or the path to a particular folder or file on your hard drive.

Whenever Windows, a program or hardware device needs certain settings or information, it consults the Registry for the specific values it needs, enabling it to function correctly. These keys, sub-keys and values are usually added when the software or hardware is first installed, and organised in such a way as to be accessible (many software and Windows settings are found inside the HKEY_CURRENTUSER > SOFTWARE key, for example).

ACCESS AND EDIT THE REGISTRY

The best tool for accessing the Registry is Registry Editor (regedit.exe). This is built into Windows and has all the tools you need for editing the Registry.

The quickest way to access it is by pressing 'Win-R' or typing "regedit" and hitting Enter, or you can open the Windows folder and create a shortcut to regedit.exe from there, to pin where you want. Regedit naturally requires administrator access, so click 'Yes' when prompted after launching it.

You'll see a two-paned window – in the left are the keys and sub-keys, while the right-hand window displays the values currently associated with the selected key. In terms of Windows and application settings, the best key to start looking inside is the HKEY_CURRENTUSER key. Double-click this, and you'll see its sub-keys appear. Double-click one of these, and its sub-keys will appear, and so on and so forth. Select a key to see its associated values appear in the right-hand window.

Navigating the Registry can be a time-consuming process as you move

between keys, sub-keys and values. One way to speed up access to frequently viewed sub-keys is to make use of Regedit's Favorites feature – select the key you want easy access to, and choose 'Favorites > Add to Favorites'. By default, the sub-key name is given as its entry – you might want to tweak this to make it easier to link (tip: use abbreviations like 'HKLM' for HKEY_LOCAL_MACHINE to keep things relatively short), and click 'OK'. In future, jump back to the key by selecting it from the Favorites menu.

There are other useful shortcuts when navigating Registry Editor. For instance, open a key containing dozens of sub-keys and you can quickly jump to one of these by typing the first two or three letters of its name. Or use the cursor keys to navigate around the Registry, using the left arrow to collapse previously opened sub-keys.

TWEAK WINDOWS 10

Many Registry tweaks can be performed outside of Registry Editor, simply by using Windows' own tools and dialog boxes – for example, choosing whether or not to show hidden files is best done from File Explorer's 'Options' dialog (select the 'View' tab). With this in mind, we're going to focus on tweaks you can't make using Windows' own tools.

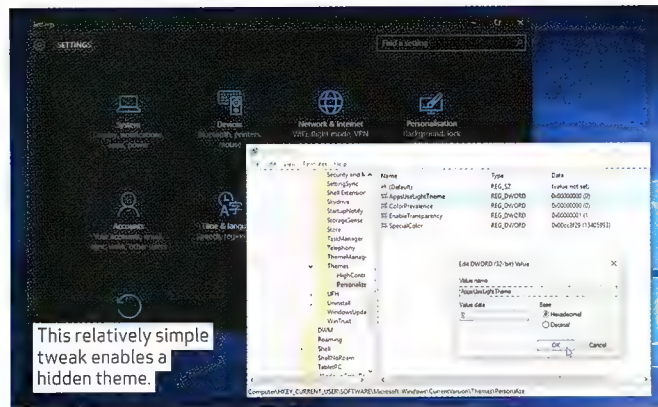
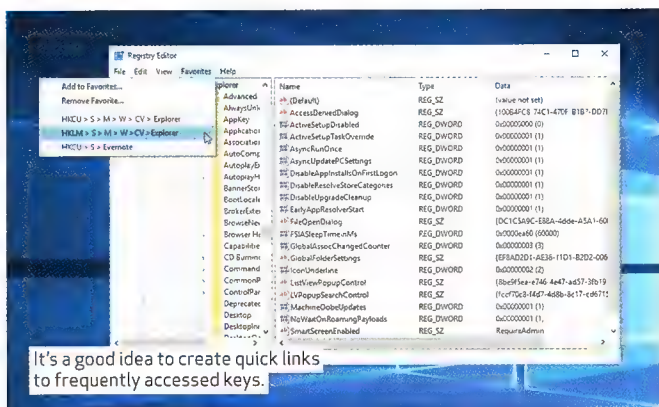
Let's start by creating a Registry value that enables the hidden Dark Theme in Windows 10, which provides light text on a dark background for those who need it. This will change all widgets, menus and apps such as Edge and Mail, and can easily be toggled on or off as required.

First, browse to the following key: HKEY_LOCAL_MACHINE > SOFTWARE > Microsoft > Windows > CurrentVersion > Themes > Personalize.

If 'Personalize' doesn't exist, right-click the 'Themes' key and choose 'New > Key' to create it. Once done, select Personalize in the left-hand pane, then right-click on some blank space in the right-hand pane and choose 'New > DWORD (32-bit) Value'. Name the value 'AppsUseLightTheme', then double-click it and verify its value is 0 (it should be by default). Next, you need to switch to the corresponding folder in the HKEY_CURRENTUSER branch – the swiftest way to do this is to right-click the Personalize key, and choose 'Go to HKEY_CURRENTUSER'.

Once there, create 'AppsUseLightTheme' there, too, again with a value of 0.

Conventional wisdom tells you to reboot your PC (or log off Windows) to enable most tweaks, but in this case, the change is immediate – just click 'Start > Settings' to see the new theme in action. How do you undo this particular tweak? You have two



What goes where?

Decoding the Registry's lingo.

The Registry is divided into five main keys or hives — here's what goes where.

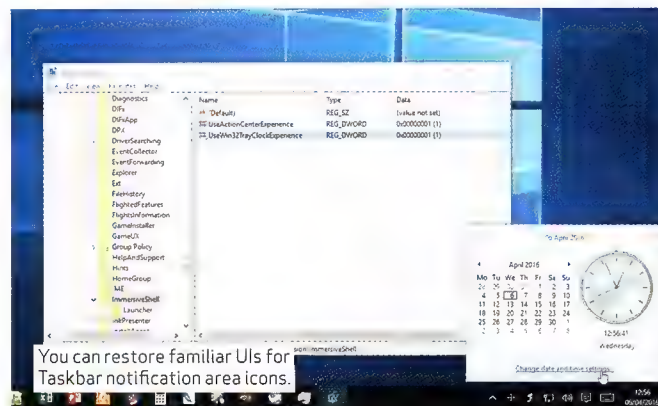
HKEY_CLASSES_ROOT: This is where file extension association information is stored, with individual sub-keys for each file type. It basically tells Windows what to do when you open or view anything, from a specific file to a drive on your PC.

HKEY_CURRENT_USER: This contains per-user settings and options, for Windows and applications. It's actually an alias that points to your user's sub-key that's stored under HKEY_USERS, which is created when you log on to Windows. Note you can still edit its contents, but you're effectively editing the contents of the HKEY_USERS sub-key.

HKEY_LOCAL_MACHINE: This is where most application and Windows settings can be found, and corresponds to preferences and options that apply to all users. If a program is installed for all users, its data is stored here; if it's installed for just one user, then its settings are instead found under HKEY_CURRENT_USER.

HKEY_USERS: This is the actual location of all individual user settings and options. Each sub-key corresponds to a user profile's security ID, which begins 'S-1-5-xx'.

HKEY_CURRENT_CONFIG: This is another alias. This key points to the 'HKEY_LOCAL_MACHINE > SYSTEM > CurrentControlSet > CurrentControlSet > Hardware Profiles > Current' key, which stores information about the current hardware profile in use. It's basically a convenient shortcut to these settings.



options: one, simply delete both values you created, or you can double-click each one in turn and change them to 1, enabling you to switch back and forth easily.

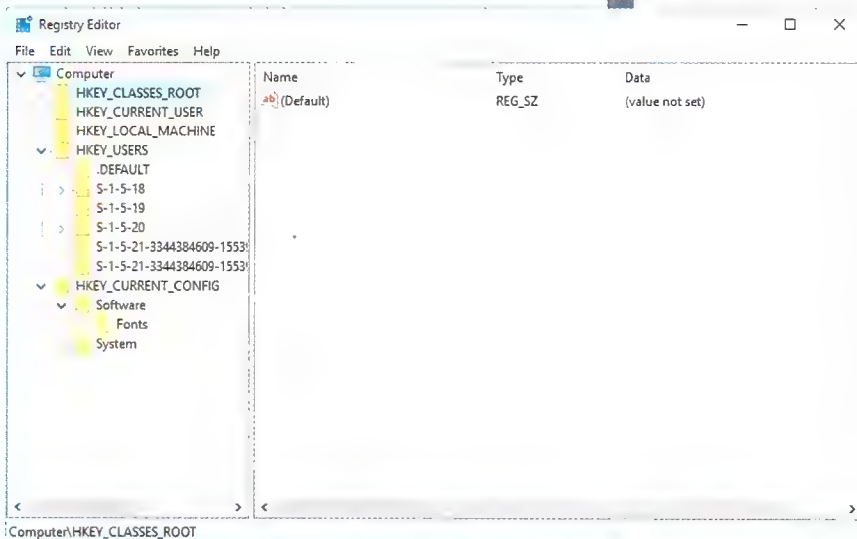
When you are expected to reboot, try simply restarting the Explorer process first. To do this, right-click 'Task Manager', click 'More details' if necessary, then scroll down to the bottom of the Processes tab, where you'll find Explorer in the 'Windows Processes' section. Right-click Explorer and choose 'Restart' and the tweak should — in most cases — be applied.

MORE GREAT TWEAKS

The next tweak enables you to increase the transparency on the Taskbar. Go to 'HKLM (HKEY_LOCAL_MACHINE) > SOFTWARE > Microsoft > Windows > CurrentVersion > Advanced' and create a new DWORD (32-bit) Value called 'UseOLEDTaskbarTransparency'. Give it a value of 1, then select 'Start > Settings > Personalization > Colors' and flick the 'Make Start, taskbar, and Action Center transparent' switch on (or off and on again if it's already enabled) to see the tweak in action. Again, changing the value to 0 or deleting the value, will remove the tweak.

The next three tweaks enable you to restore various Taskbar notification area user interfaces from Windows 7 and 8.1.

First, the volume control: browse to 'HKLM > SOFTWARE > Microsoft >



"Save time moving and copying files by adding two options to the context menu."

Windows NT > CurrentVersion', then create a key called 'MTCUVC' under 'CurrentVersion'. From here, create a new DWORD value called 'EnableMtcUvc' and set its value to 0.

To restore the Windows 7 classic UI for both Date and Time, and Battery, browse to 'HKLM > SOFTWARE > Microsoft > Windows > CurrentVersion > ImmersiveShell'. Restore the UIs by creating two DWORD values called 'UseWin32TrayClockExperience' and 'UseWin32BatteryFlyout', respectively, then set their values to 1.

Don't like the way Windows has removed balloon notifications in favour of slide-in 'toasts'? Go to 'HKCU (HKEYCURRENTUSER) > SOFTWARE > Policies > Microsoft > Windows > Explorer', create a new DWORD value called 'EnableLegacyBalloonNotifications' and give it a value of 1.

Want to hide selected user folders from view when browsing This PC? Browse to 'HKLM > SOFTWARE > Microsoft > Windows > CurrentVersion > Explorer > FolderDescriptions'. You'll see a string of strangely named keys, each pointing to a different shell folder. Restrict your search to those keys with '>' next to them, indicating they have sub-keys. Select each one in turn and use the 'Name' value to help identify them as Local Pictures, Desktop, Documents, Downloads, Music and Videos folders — the 'Local' reference confirms they're your personal user folders. Expand the key and select the 'PropertyBag' key inside it. You'll see a REG_SZ value called 'ThisPCPolicy' in the right-hand pane. Double-click this and change it from Show to Hide. This will hide the folder in This PC view after you've restarted Explorer.

ADD OPTIONS TO CONTEXT MENU

Save time moving and copying files by adding two options to the context menu that appears when you right-click a file or folder. Browse to 'HKEY_CLASSES_ROOT > AllFilesystemObjects > ShellEx > ContextMenuHandlers', then create two sub-keys beneath this called 'Move To' and 'Copy To', respectively. Select the Move To key, then double-click the '(Default)' value and change it to: {C2FBB631-2971-11D1-A18C-00C04FD75D13}. Now double-click '(Default)' under the Copy To key, and change it to: {C2FBB630-2971-11D1-A18C-00C04FD75D13}. The change is immediate — right-click a file or folder in File Explorer to see the options appear.

The following tweak makes it easy to open files in Notepad to view and edit. Browse to 'HKEYCLASSES_ROOT > * > Shell'. Create a new sub-key called 'Open with Notepad' and create another sub-key inside that called 'command'. With 'command' selected, double-click '(Default)' and change its value to 'notepad.exe %1'. If you have another text editor installed in your Program Files folder, you can use that instead — for example, 'notepad++.exe'. Change the 'Open with...' sub-key's name to suit — it's what's displayed on the context menu when you right-click a file.

BOOST PERFORMANCE

Registry tweaks aren't just about wresting back control over the interface — dig deeply and you can even make certain aspects of Windows run faster, too. And we're not just talking about visual tricks, such as making menu entries appear quicker (although if you'd like to do that, navigate to 'HKCU > Control Panel > Desktop', and experiment with the 'MenuShowDelay' value — try a setting of 20, and reboot to feel the effects).

Windows 10 has a built-in delay before it starts loading programs from the Startup folder, to give itself time to load. If you're running Windows on a fast PC, you can try eliminating the delay to see if it speeds up the overall startup time. Navigate to 'HKCU > SOFTWARE > Microsoft > Windows > CurrentVersion > Explorer'. Create a new sub-key called 'Serialize', then create a new DWORD value inside 'Serialize' called 'StartupDelayInMSec'. Leave its value set at 0, reboot and see if it makes a difference (remove it if it slows things down).

The following tweaks may help speed up your gaming performance. The first may reduce latency and ping in some games. Browse to 'HKLM > SYSTEM > CurrentControlSet > Services > Tcpip > Parameters > Interfaces'. You'll see a list of keys relating to different network interfaces — identify your Wi-Fi or Ethernet adapter from the IPAddress value, then create three new DWORD values: 'TcpAckFrequency', 'TCPNoDelay' and 'TcpDelAckTicks'. Set the first two to 1, and leave the last one at 0.

Next, try disabling network throttling. Browse to 'HKLM > SOFTWARE > Microsoft > Windows NT > CurrentVersion > Multimedia > SystemProfile'. Double-click or create a new DWORD called 'NetworkThrottlingIndex' and set its

Back up the Registry

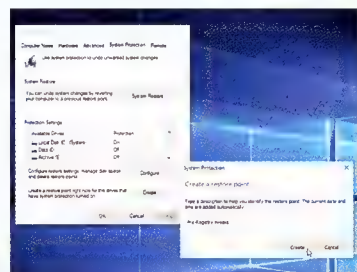
Give yourself a fall-back.

Before you start tweaking the Registry, ask yourself what you'll do if something goes wrong. Most tweaks won't bring your system grinding to a halt, but they may render applications unusable or result in strange behaviour you weren't expecting. Some Registry edits are easier to undo than others as well — so make things easier for yourself (and your health) by following a multi-layered approach to taking precautions.

Before you begin, take a System Restore point, which backs up the Registry in its current state, as well as other system files. Type "system protection" into the Cortana search box, and select 'Create a restore point'. Verify System Restore is switched on for your system drive (click 'Configure...' if it's not), then click 'Create'. Give your Restore point a suitable name, such as 'Pre-Registry tweaks' and click 'Create' again.

This is your fall-back backup. If all else goes wrong, you can access System Restore from within Windows itself (click 'System Restore...' from the 'Create a Restore point' screen), or from the list of recovery options if Windows won't boot — choose 'Troubleshoot', then 'Advanced' and 'System Restore' to select the Restore point you created earlier.

It's also a good idea to back up individual Registry keys before you start changing them — this is done from within Registry Editor. Right-click the target key in the left-hand pane and choose 'Export'. Again, give your backup a suitable name (and save it to your backup drive) before clicking 'Save'. Backed-up settings are stored in the .REG format — you can restore them via 'File > Import' inside Registry Editor, or simply by double-clicking the file and clicking 'Yes' twice. These settings will overwrite your changes, restoring things to how they were.



Take a fail-safe backup of your Registry before editing it.

"You'll find that the Internet is littered with Registry tweaks for you to try."

Build registry scripts

Quick edits made easy.

Why get your hands messy with Registry Editor when you can make changes to the Registry directly from Notepad? By creating special script files using any text editor, then saving them with a .REG file extension, you simply have to double-click the .REG file to merge your changes into the Registry.

To do this, open a blank document in Notepad. Type the following line at the top:

Windows Registry Editor
Version 5.00

This identifies the script as a Registry file. Add a blank line beneath this, then type below that:

[Regpath]

Keep the square brackets, but replace "Regpath" with the Registry key you wish to edit (any sub-keys that don't already exist will be automatically created, so no need to manually create them in Regedit first). Beneath this, type each of the values you wish to create or modify on separate lines using the following syntax:

"ValueName"=Valuetype
:Value

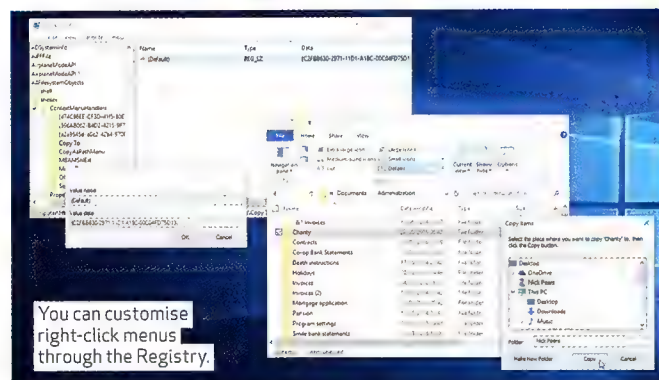
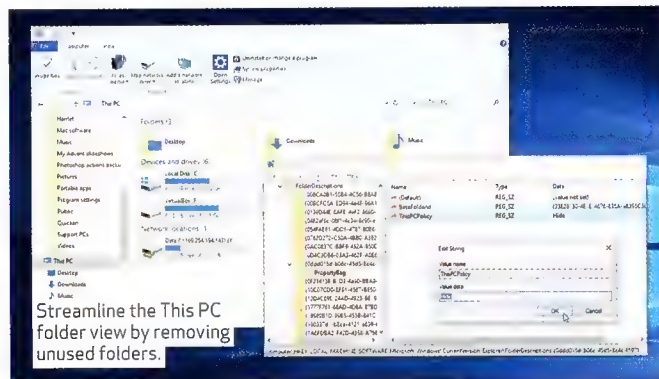
Ignore 'Valuetype' if the value is a string; otherwise, enter "binary" for hexadecimal values or "dword" for dword values. You can edit multiple Registry keys within a single document — make sure to leave a blank line between each '[Regpath]' entry. The screenshot below reveals how this works in practice. Once done, choose 'File > Save', change 'Save as type:' to 'All Files' and remember to save your file with a .reg extension. Once done, back up, then double-click the file to merge it into the Registry, or right-click it and choose 'Edit' to make changes to it.

dark-theme.reg - Notepad

Windows Registry Editor Version 5.00

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Themes\Personalize]
"AppsUseLightTheme"=dword:0

[HKEY_CURRENT_USER\SOFTWARE\Microsoft\Windows\CurrentVersion\Themes\Personalize]
"AppsUseLightTheme"=dword:0



Hexadecimal value to 'ffffff'. While here, edit (or create) the 'SystemResponsiveness' DWORD value, but set this to '00000000' for maximum streaming.

Browse from here to the 'Tasks > Games' sub-key. Verify 'GPU Priority' is set to 8, and change the Priority value to 6, which will throw more system resources at games.

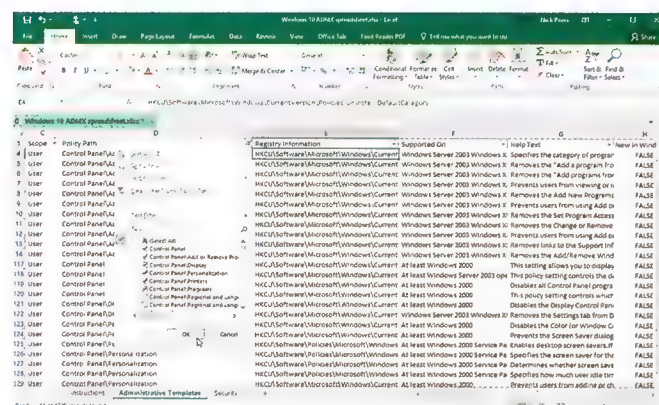
FIND MORE TWEAKS

You'll find that the Internet is littered with Registry tweaks for you to try, but always take precautions before you follow any — see the box on backing up, back over the page. Tweaks from older versions of Windows (particularly Windows 8 and 8.1) should also work in Windows 10, but it's not always guaranteed.

When surfing the net for useful tweaks — particularly when it comes to securing your PC — you'll often find a

reference to 'gpedit.msc' or Group Policy Editor. This handy tool makes it easy to set various security and privacy policies in Windows, and while it's aimed at enterprise and business users, it's often handy for us mere mortals, too.

The only problem with gpedit.msc is that it's not available in Home editions of Windows. But don't worry, because Group Policy Editor is a neat front-end for various Registry settings — all you need to know is which tweak applies to which Registry setting, and thanks to a handy Excel file from Microsoft, you can do just that. Download the 'Windows 10 ADMX spreadsheet.xlsx' file from www.microsoft.com/en-us/download/details.aspx?id=25250 for the translation you need.



Who needs gpedit.msc when you have the Registry?



The home of technology

techradar.com

how to

» QUICK TIPS

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

HARDWARE

'BONDING AND GROUNDED'

I'm trying to build a simple rover out of Lego and scavenged electronics, as a father-son project, but I have a few questions. If I use an Arduino Leonardo as the controller, it only has three ground pins and I need four because each wheel has its own motor. Is there a way to multiplex these pins in software somehow?

Tarrant Morten

Ground is ground across the entire circuit. The point of the ground connection is to provide a reference point for all the signal and power lines. For that to work, all the ground connections are shared. The Arduino provides multiple ground pins as a convenience, and so you don't need to sink all your current through a single pin, which could lead to overheating.

However, you can't just connect one lead of a DC motor to a ground pin and the other lead to a digital IO pin. The IO pins are rated for a maximum of 40mA and a typical small DC motor might draw 250mA. A single motor will blow the IO pin; four motors would exceed the total power that the Arduino can supply. You need to power the motors separately with their own batteries and use the Arduino to control their speed using a pulse-width modulation (PWM) circuit. There's actually a tutorial for this at tinyurl.com/apc429-qanda.

Luis Villazon

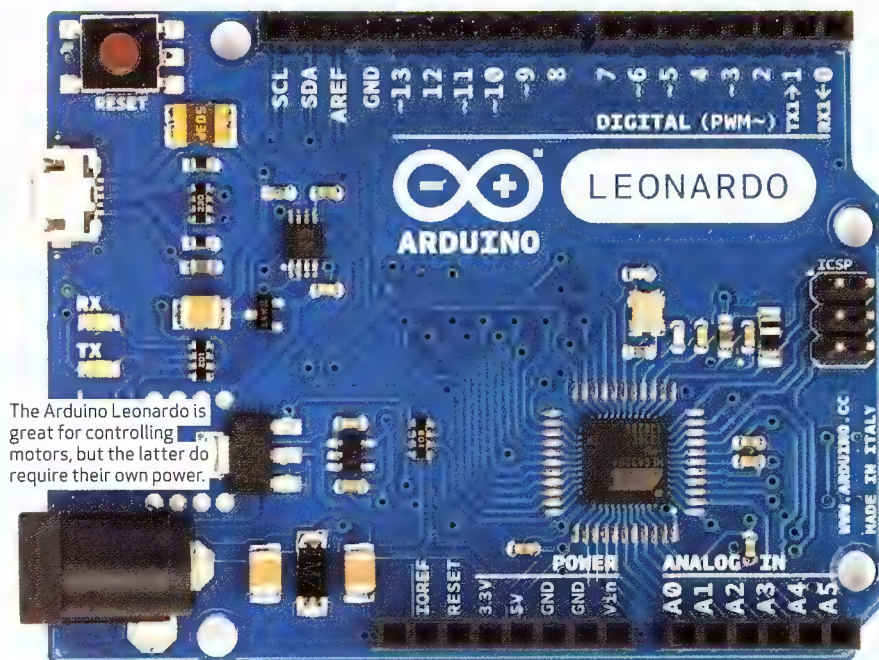
INTERNET

'PROXY ISSUES PERSIST AFTER' UPGRADE

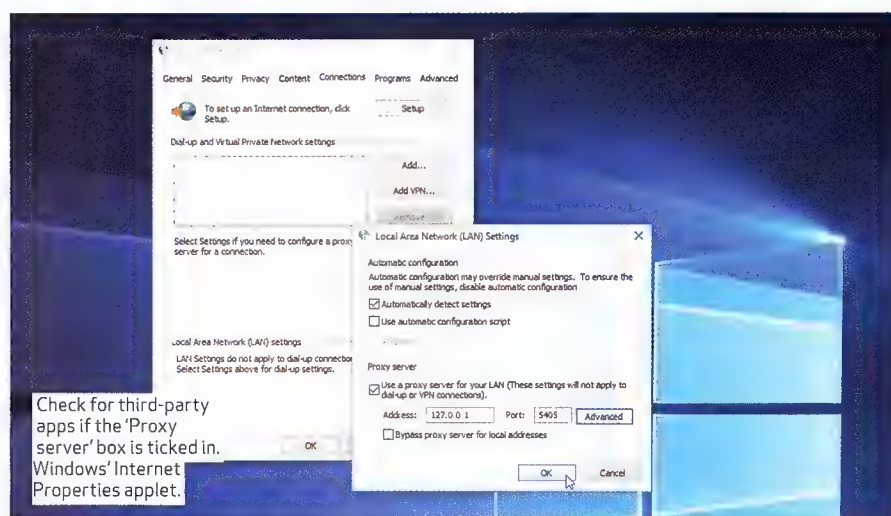
I've upgraded my PC to Windows 10, but continue to be plagued by a particular problem. Every time I start my PC followed by my browser, I discover both 'Use Proxy server for your LAN' and 'Bypass proxy server for local addresses' are ticked under 'Internet Options'. Most of the time, these settings don't particularly matter, but there are times when they do (and it's annoying) — can you help me pinpoint the problem?

Michael Cooper

These settings should be unticked by default, which indicated a third-party



The Arduino Leonardo is great for controlling motors, but the latter do require their own power.



program or setting was responsible. Michael then remembered he'd invested in OnSpeed so that he could obtain a IP address from the UK while travelling abroad, and removing this resolved the issue. If you can't identify the culprit, and scans with both your antivirus software and Malwarebytes Anti-Malware Free (www.malwarebytes.org) come up clean, try examining what programs and

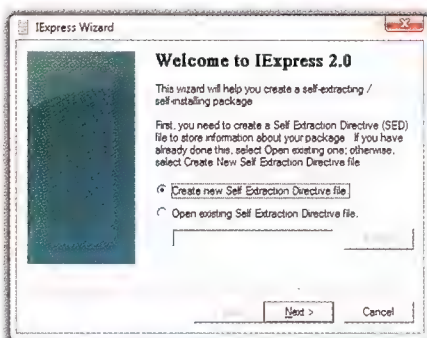
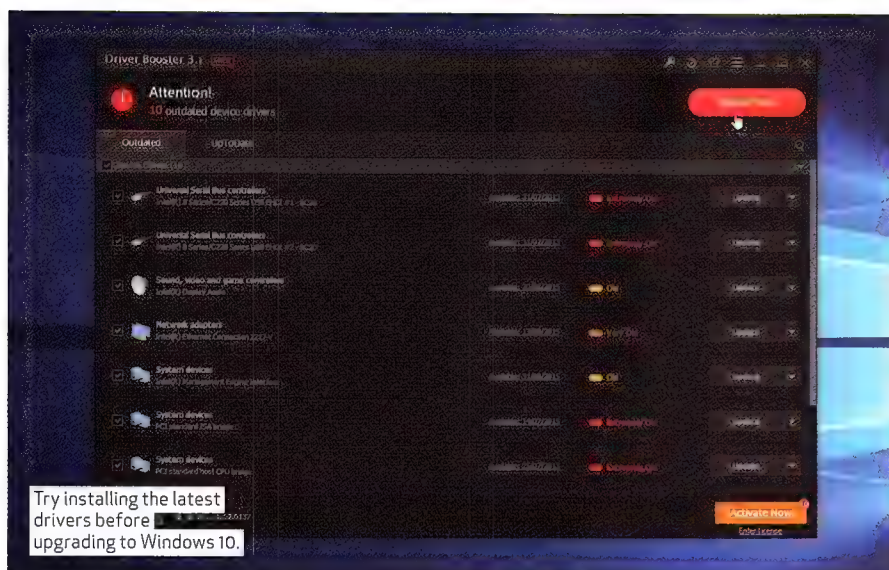
services are launching with Windows using a tool such as HijackThis (sourceforge.net/projects/hjt) to help locate the trouble.

Graham Barlow

WINDOWS

'WINDOWS 10 UPGRADE DEAD-END'

I've wasted a lot of time trying to upgrade my older PC from Windows 7 to Windows 10 with no success. I'm getting a C1900101-



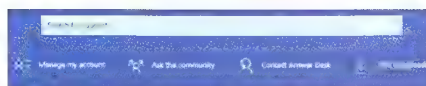
Windows has a built-in tool that can convert BAT files to EXEs.

40017 error. Can you help? Gerry Potter

Unfortunately, Gerry is one of a growing number of people with older PCs that have learned the hard way that, despite being told otherwise by the Windows 10 Update tool, their computer doesn't support an update to Windows 10.

In the vast majority of cases, this is down to outdated drivers, and this is where the main issue arises. If the computer manufacturer (Acer, which now owns the Packard Bell name, in this instance) doesn't want to maintain updated drivers for a computer, then its chances of supporting Windows 10 reduces significantly. In Gerry's case, his PC model is conspicuous by its absence on the Packard Bell website for models listed as being supported for the Windows 10 upgrade. He tried sourcing later drivers from other sources using the IObit Driver Booster tool (www.iobit.com/en/driver-booster.php) and even reinstalled Windows 7 from scratch, but the update still stubbornly refused to install, throwing up a C1900101-40017 message each time.

Because the issue is driver-related, Gerry may be able to identify the specific problem blocking his upgrade



Error message occurs after you change the SATA mode of the boot drive

Symptoms

After you use the BIOS setup of a Windows 7-based computer or a Windows Vista-based computer to change the Serial Advanced Technology Attachment (SATA) mode of the boot drive to use either the Advanced Host Controller Interface (AHCI) specification or redundant array of independent disks (RAID) features, you receive the following error message when the computer is restarted:

STOP 0x0000007B INACCESSIBLE_BOOT_DEVICE

Cause

This issue occurs if the disk driver in Windows 7 or Windows Vista is disabled. This driver must be enabled before you change the SATA/RAID mode of the boot drive.

Fix it for me

To resolve this issue automatically, click the Fix this problem link. Then, click Run in the File Download dialog box and follow the steps in this wizard.

[Download](#)

Note: This wizard may be only in English. However, the automatic fix also works for other language versions of Windows.

Note: You are not on the computer that has the problem; you can save the automatic fix to a flash drive or to a CD so that you can run it on the computer that has the problem.

Let me fix it myself

Important: This section, method, or task contains steps that tell you how to modify the registry. However, serious problems might occur if you modify the registry incorrectly. Therefore, make sure that you follow these steps carefully. For added protection, back up the registry before you modify it. Then, you can restore the registry if a problem occurs. For more information about how to back up and restore the registry, click the following article number to view the article in the Microsoft Knowledge Base:

247834 How to back up and restore the registry in Windows

To resolve this issue yourself, enable the AHCI driver in the registry before you change the SATA mode of the boot drive. To do this, follow these steps:

1. For all Windows-based programs.
2. Click **Start**, type **regedit** in the **Start** Search box, and then press **ENTER**.
3. If you receive the **User Account Control** dialog box, click **Continue**.
4. Locate and then click one of the following registry subkeys:
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Iahci
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\IastorV
5. In the pane on the right side, right-click **Start** in the **Name** column, and then click **Modify**.
6. In the **Value data** box, type **0**, and then click **OK**.
7. On the **File** menu, click **Exit** to close Registry Editor.

Microsoft's instructions to edit your registry and turn on the AHCI storage driver.

by examining the setupapi log files, which he'll find at 'C:\Windows\Inf\'. If he's able to pinpoint the problematic driver, he may be able to take steps to rectify it and install Windows 10.

Nick Peers

BOOTING

IDE TO AHCI

My PC has a 256GB SSD as its primary drive. Back when I installed it, I neglected

to tell the BIOS to boot up in AHCI mode. There aren't a lot of clear guides on how to properly make this switch without reinstalling Windows, unfortunately. I know it involves a registry tweak and booting into safe mode to get the AHCI drivers loaded. But is this even recommended? Alternatively, when I make the jump to Windows 10, will I be able to finally tell my motherboard to boot in AHCI mode after a fresh installation?

Kevin Bunkley

To answer your first question: yes, enabling the AHCI driver through your registry is a perfectly viable approach. In fact, Microsoft has a support page addressing this exact question at support.microsoft.com/en-us/kb/922976. There, you'll find a 'Fix this problem' link able to make the tweak without your intervention. If you'd rather step through the process manually, start by opening regedit. Navigate to either 'HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Msahci' or 'HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\IastorV', depending on the software you currently have installed. On the right-hand side of the window, under the column called 'Name', you should see an entry titled 'Start'. Right-click it and choose the default option, 'Modify'. Make sure the Value data field is populated with a '0' and click 'OK'. Close regedit and restart. AHCI enabled, turn it on in your firmware.

When you make the jump to Windows 10, there's a good chance you'll be upgrading. As far as we know, that process won't touch your BIOS. So make the switch to AHCI first, then install Windows 10.

APC team

PROGRAMMING SECRET CODE

I'm trying to create an installation routine for an application. It's nothing too complicated and, at the moment it's handled using a BAT file but I'd like to convert this to an EXE. Is there a utility that can truly 'compile' BAT files? I've tried 'Advanced BAT to EXE Converter' but the free version doesn't allow me to distribute the resulting files.

Adam Whitney

These converter apps don't actually compile the batch file — they just perform some simple encryption to obfuscate the original batch file code and then parcel it up with an executable header. You can actually use Windows Process Explorer to watch as the embedded batch file is extracted to a temporary folder and then executed normally.

We wouldn't worry about this being a bother to end users; the process is

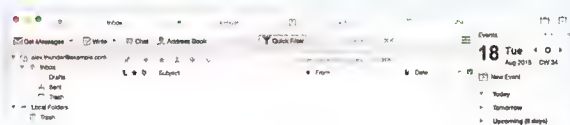


Thunderbird

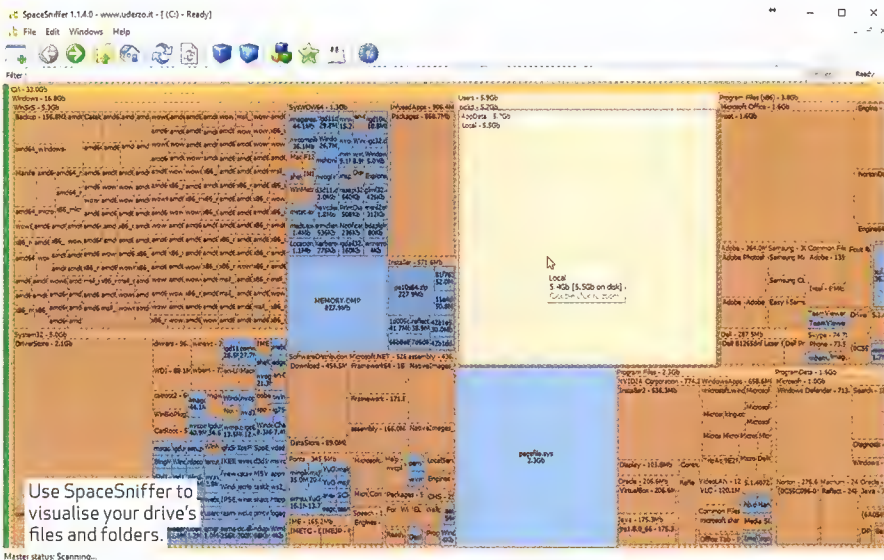
Software made to make email easier.

Thunderbird is a free email application that's easy to set up and customize – and it's loaded with great features!

Free Download



If you want to move around web emails en masse, it might be easier to use Mozilla's Thunderbird email client.



Use SpaceSniffer to visualise your drive's files and folders.

baffles me as I thought it would remain fairly static. Is there something I'm missing?
Joff Hopkins

The upgrade to Windows 10 (plus subsequent reinstallations) don't format the drive, so files are being left behind by each outdated installation. We instructed Joff to download SpaceSniffer from www.uderzo.it and run it as an administrator, then examine the results. He sent us a screenshot that revealed the System Volume Information folder was more than 40GB in size. This folder is where System Restore points are stored, and the easiest way to remove these files is to shrink the size of your System Restore cache. To do this, right-click the Start button and choose 'System'. Click 'System Protection' in the left-hand pane. When the dialogue box opens, select drive 'C:' under 'Protection Settings' and click 'Configure'. You'll see a slider – if it's set to 10% as is likely, it means Windows is reserving up to 100GB drive space for System Restore points.

This is overkill, so use the slider to reduce the space reserved – all the way down to 2% (20GB should be ample for most people's needs). There's also a Delete button here – click this to purge all existing Restore points, then click 'OK' followed by 'Create' to create a new Restore point to use going forward. You'll find the missing 40GB has now been restored.

Matt Hanson

WINDOWS

WHAT'S DEFRAGGING MY DRIVE?

I tried to defrag my C: drive yesterday, but Windows 7 told me that the Disk Defragmenter is currently using customised settings created by another program. It's told me if I'd like to modify the schedule, I'll have to remove those settings – it gives me the option of doing so, but can you clarify what this means? Will it do any damage if I remove the settings?
Bernard Donohoe

There's no need to manually defrag your drive in Windows 7 or later, Bernard – normally, Windows takes control of the situation, although it's also possible for third-party tools to manage the defragmentation process, too. It sounds like your PC's drive is being defragged so unless you have reason to want to intervene yourself, it's best left alone.

Nick Odantzis

INTERNET

THE NEWS ON EDGE

I've been using the Maxthon browser for years and have some questions about Microsoft Edge, which I plan to switch to when I get a Surface Book. First, can I

transparent and the batch file is deleted after it has run. But it does mean there's no point paying the US\$49.95 for the Pro version of Advanced BAT to EXE Converter. You can just use IExpress, which has been bundled with Windows since XP.
Luis Villazon

SECURITY

SECRETS TO THE GRAVE

I've been emailing an old friend for several years. The only thing is that we aren't actually sending emails between addresses. We share a single account (using Yahoo) and simply save our messages in the drafts folder. The problem is I would like to migrate from Yahoo to Gmail, which I believe is more secure. Before I can do this, I need some way of migrating all the Yahoo messages from the drafts folder to the new Gmail address. Which would be fine, except that there are just under 5,000 messages to move!

Yahoo doesn't let me just select them all and hit forward – I can only view 50 at a time on the screen. Is there a quicker way to save these

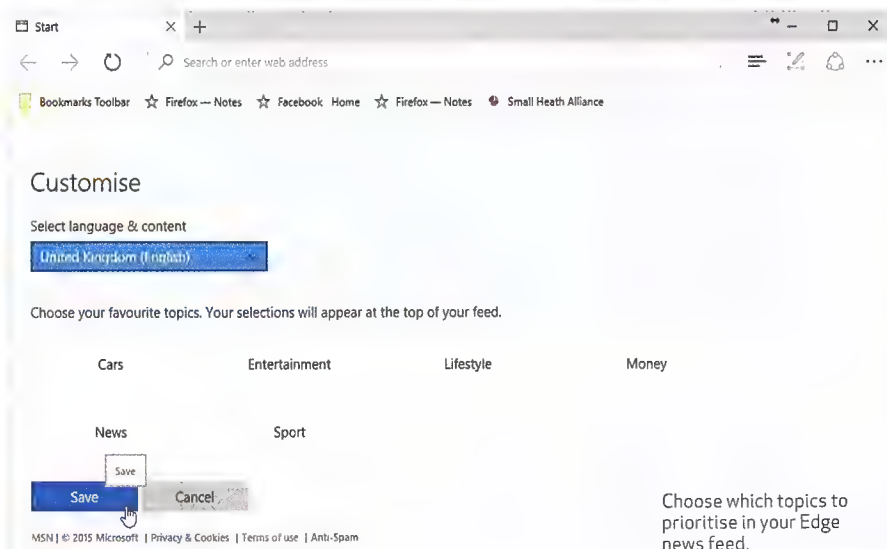
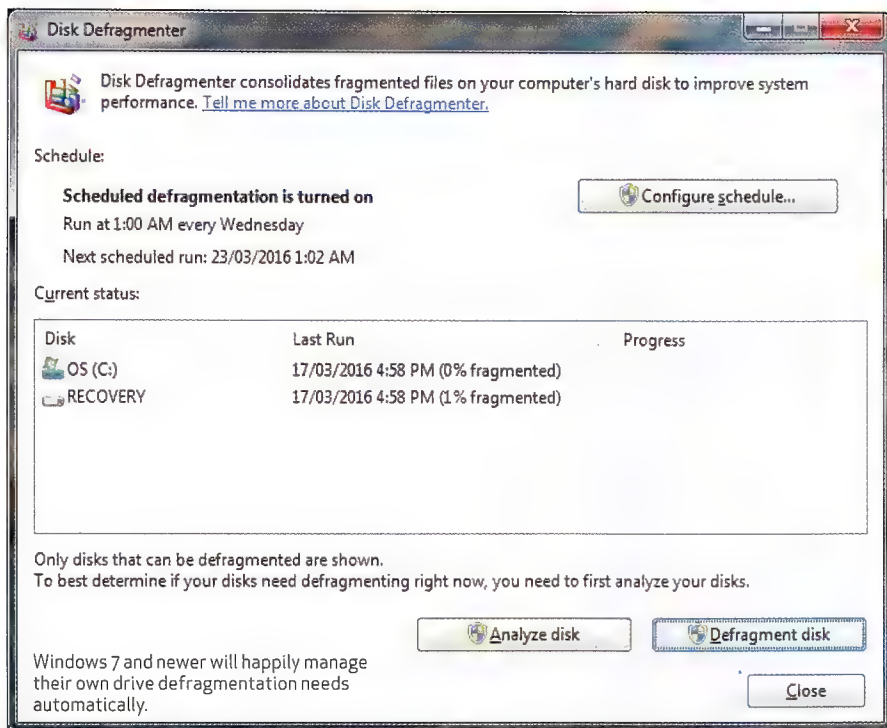
messages for posterity? I'm using Windows 7.
Peter Mantel

If you really can't bring yourself to delete (or simply abandon) these old messages, you can use Mozilla Thunderbird (www.mozilla.org/thunderbird) to connect to your Yahoo webmail and this will let you select all the messages in any given folder or mailbox. If you're really concerned about security, though, instead of forwarding them to another address you should consider saving them in a big text file on your PC. Then right-click the file and choose 'Properties' > General > Advanced > Encrypt contents to secure data'.
Luis Villazon

WINDOWS

LOST SPACE ON DRIVE

When Windows 8.1 was installed on my laptop, I had 870GB free space, but having upgraded to Windows 10 (and subsequently reinstalling it twice) my free space has dropped down to 828GB, even after deleting the Windows.old folder. This



display favourites at the top of the browser rather than on the right, like I can in Maxthon? Second, can I automatically open links in a new tab without having to right-click them? And finally, how do I rearrange the home page to show news feeds?

Richard Jones

Richard was referring to Maxthon's bookmarks toolbar with his initial question, and the good news is that Edge has this feature, too: place your bookmarks in the Favourites Bar folder, then enable the toolbar via the switch you'll find by opening Edge's Settings and clicking 'View favourites settings'. We're not aware of any setting you can apply to make Edge open links in new tabs by default, but hold Ctrl-Shift as you click a link and it'll have the same effect, or set up your

mouse's central button to do this, if you use one. Finally, open a new blank tab and click 'Customise' above 'Top Sites'. From here, you can choose to show the news feed, plus select up to six topics to prioritise what news stories are shown.

Cat Ellis

STORAGE

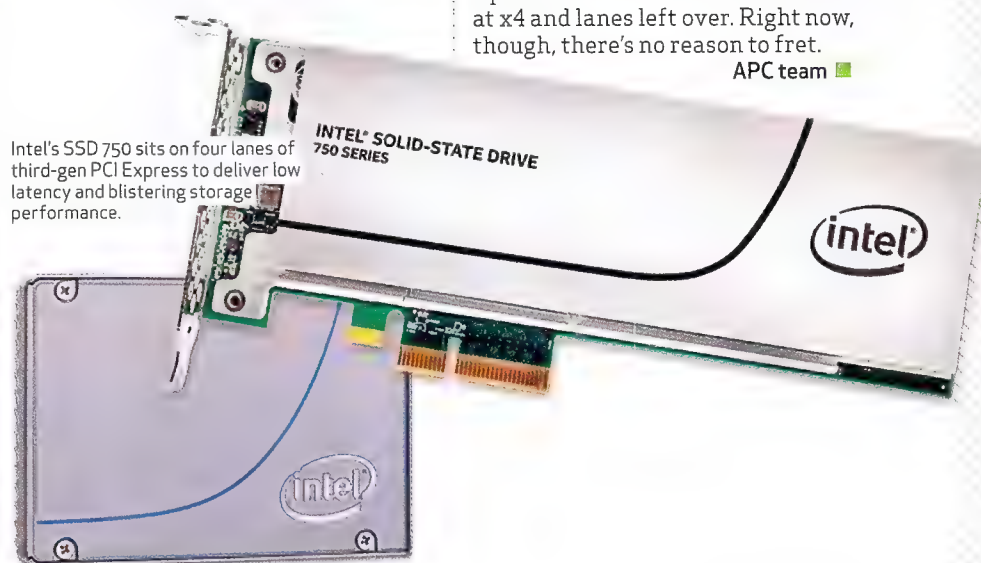
PREVENTING BOTTLENECKS

I'm running a Core i7-4771 (Haswell) on an MSI Z97S SLI Plus motherboard with 16GB of memory, an Intel SSD 750 400GB drive, and a GeForce GTX 770 graphics card. I understand that the two PCIe slots are capable of supporting one device in x16 mode or two in x8. Am I limiting my Intel SSD or Nvidia GPU in any way? Second, does the LGA 2011 interface offer more lanes to the PCIe slots? I've read that they come with 40 lanes, but want to confirm the specifications.

Robert Harris

That SSD 750 isn't limited in any way. It employs a four-lane interface, so a x8 link is more than enough. In theory, your GeForce card is getting less PCI Express bandwidth than it supports, but today's GPUs are not bottlenecked by PCIe throughput. Stick with one GTX 770 and you'll be fine. Where you'll run into trouble is if you find yourself short on graphics processing power in the future. Although MSI's Z97S SLI Plus has three PCIe x16 slots, populating them all divides the CPU's PCI Express into one x8 and two x4 links. Nvidia doesn't allow SLI across four-lane connections, so you're forced to replace that GTX 770. Enter the LGA 2011-v3 interface. Intel currently sells three different Haswell-E chips: Core i7-5960X, -5930K, and -5280K. Two sport 40-lane PCIe 3.0 controllers, while the last gives you 28 lanes. Depending on the motherboard, the highest-end models would let you run a pair of graphics cards in SLI using x16 links. The entry-level version gives you a pair of cards at x8 with the SSD 750 at x4 and lanes left over. Right now, though, there's no reason to fret.

APC team



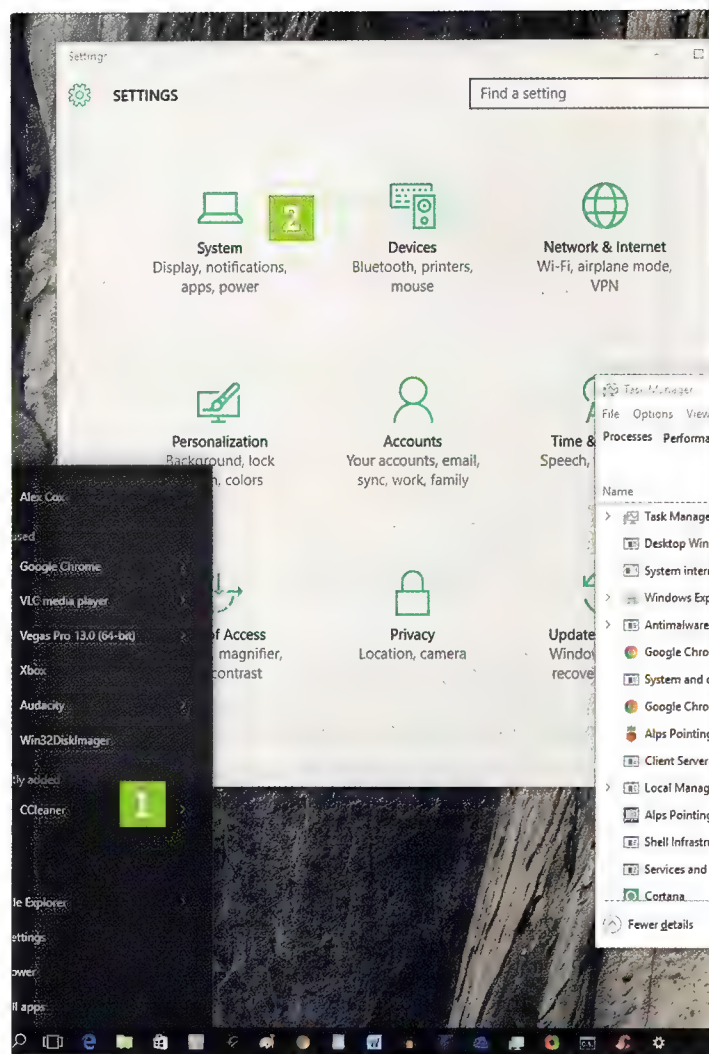
Intel's SSD 750 sits on four lanes of third-gen PCI Express to deliver low latency and blistering storage performance.

Streamline Windows 10

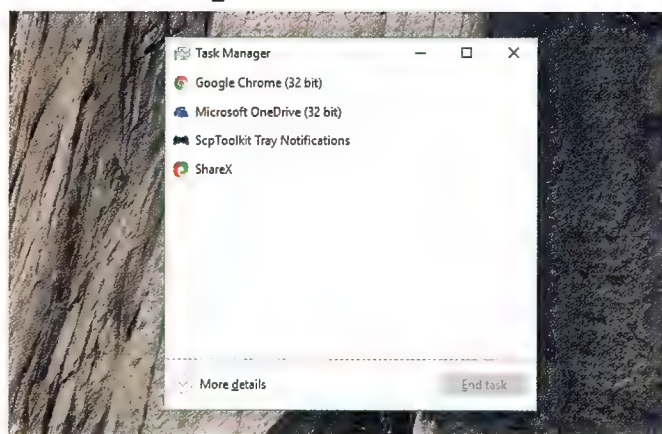
With just a little effort, you can make Windows 10 slicker, faster and easier to use. Alex Cox shows you how.

Not all computers fare particularly well in their transition to Windows 10. The promised quick, clean environment and super-fast boot time might not have materialised. Or there might be as much clutter as there was before, if not more. And for the majority who have had a pleasant Windows 10 experience, you could make it even better still.

Here, we'll speed up and clean up your system at the same time. We'll disable some of Windows 10's less-essential features, clear away unwanted clutter, and make sure you're only running the programs you need at startup. You should end up with a faster boot time and a much more elegant experience. And since most of the things we're going to do are non-destructive, you'll be able to switch back the changes at any time if you miss certain features.

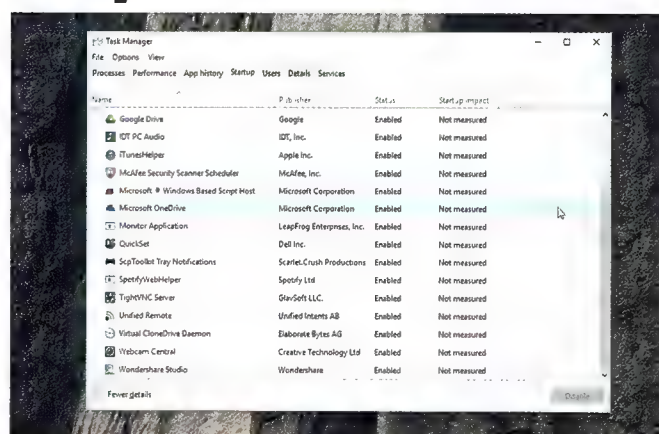


Clean your Windows 10 system



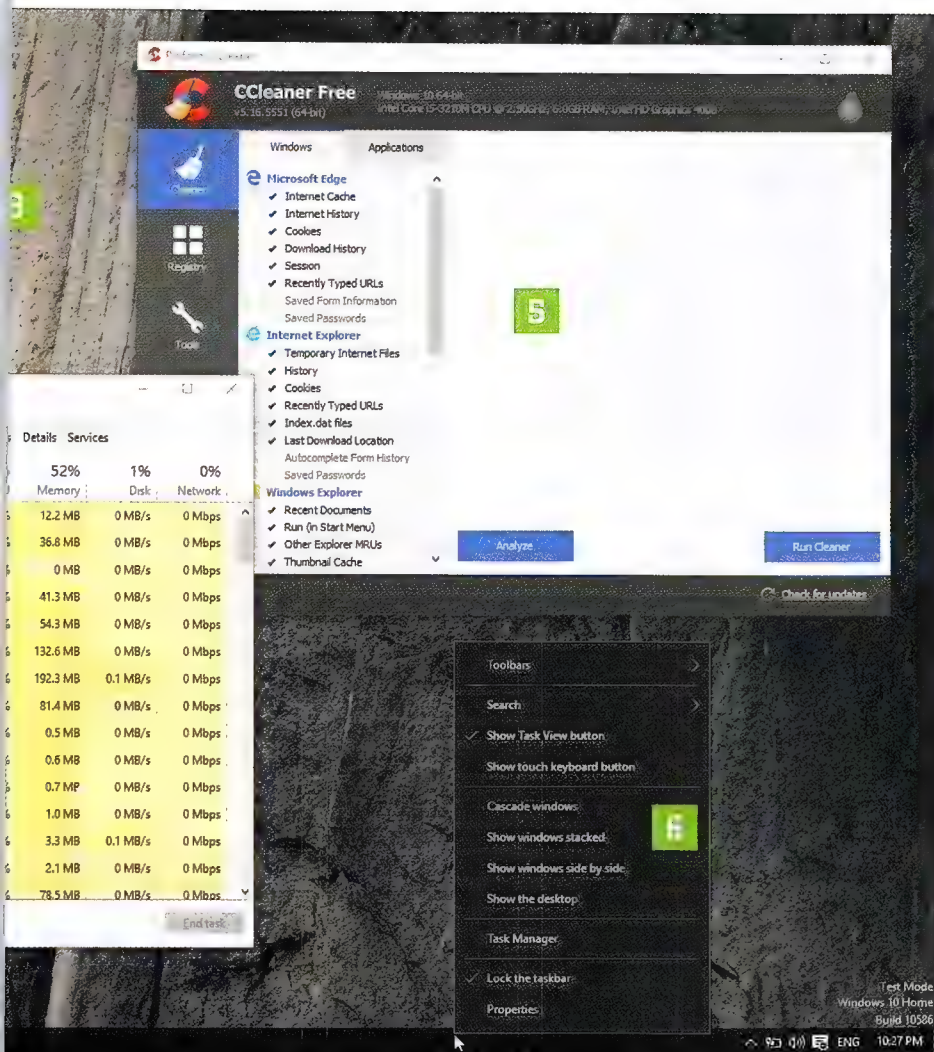
1 START ATTACK

If you've upgraded or picked up a new PC with Windows 10 preinstalled, it's likely that a number of existing programs will run at startup. Each one of these takes time to load, contributing to that laboured power on sequence. Hit Ctrl-Shift-Esc to open Task Manager, click the arrow to see more information, then click the Startup tab to see the offenders.



2 CHOOSE YOUR VICTIMS

You'll see a whole list of programs, the majority of which you've probably never used. So with the exception of your anti-virus software, you're safe to disable as many as you like. Reboot your machine, and you should notice the difference. If you disable something, then find you need it, head back to Task Manager to switch it back on again.



1 START MENU

Tidying up your Start menu might take a while, but it's well worth the effort when it looks this neat

2 SETTINGS

Many of Windows 10's newer, more vocal features can be disabled by digging through the Settings application.

3 NO ICONS

Hiding your desktop icons means you can keep your mind on what you're doing and get a less cluttered look.

4 TASK MANAGER

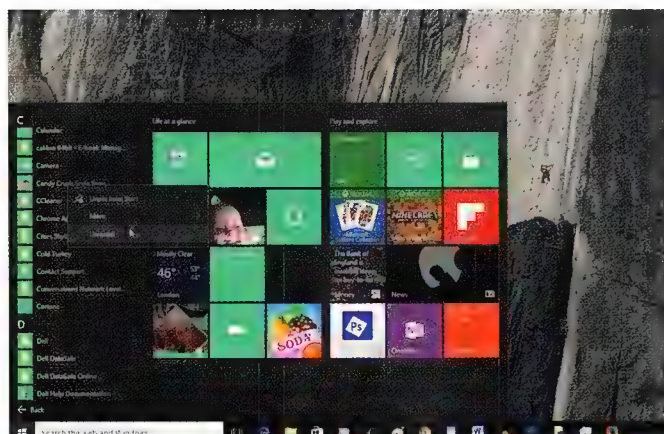
Task Manager is a great way to see which programs are bogging your PC down and, in the Startup tab, stop them running automatically.

5 CCLEANER

Sometimes, special measures are required. CCleaner can do away with certain things Windows would rather you keep.

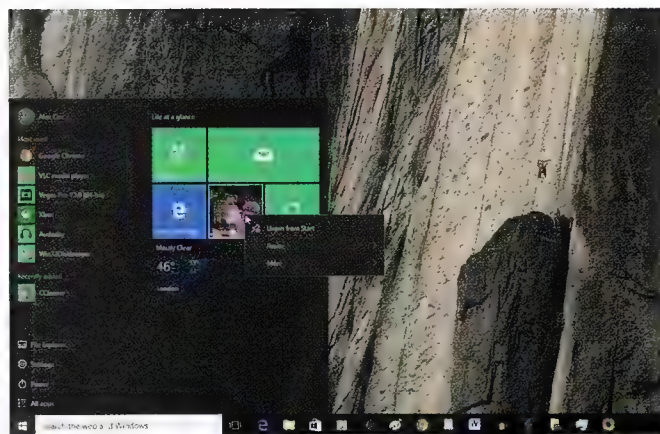
6 TASKBAR SETTINGS

Gain extra screen space with a smaller taskbar and do away with that ugly search box using its right-click menu.



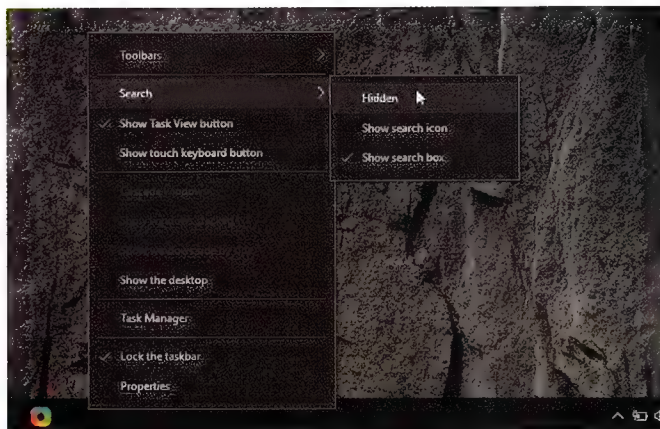
3 QUICK UNINSTALLATION

While we're dealing with software, let's clean away some unloved applications. Windows 10 makes this easier than ever. Any application you've installed can be removed by finding it in the Start Menu's All Apps list, right clicking, then selecting 'Uninstall'. Sadly, this won't work for Microsoft's preinstalled applications; however, infrequently you might use them.



4 MENU MASSACRE

Let's look at the Start Menu more closely, as it's ripe for a little streamlining. The Live Tiles on the right-hand side won't all be to your taste and, in fact, you can get rid of them altogether, although it's going to take a little time. Right-click each one, and select 'Unpin from start' until they're all gone. This will reduce your Start Menu to a single column.



5 SEARCH SILENCE

The gigantic search box at the bottom left of the screen isn't to everyone's taste, but it's easy to switch off. Right click an empty area of the taskbar, select 'Search', then 'hidden' to do away with it. You can also select the 'Properties' menu and use it to switch on small taskbar icons for a sleeker look that saves screen space and shrinks the search box down to a single small icon.

6 CHOOSE HOW UPDATES ARE DELIVERED

Updates from more than one place

Download Windows updates and apps from other PCs in addition to Microsoft. This can help speed up app and update downloads. [Learn more](#)

When this is turned on, your PC may also send parts of previously downloaded Windows updates and apps to PCs on your local network, or PCs on the Internet, depending on what's selected below.

☒ Off

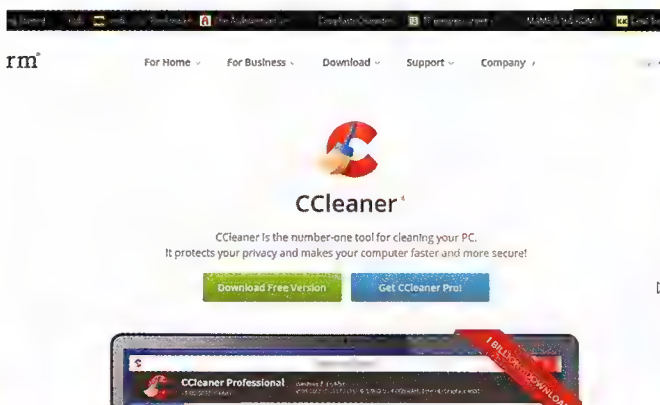
Get updates from Microsoft, and get updates from and send updates to

☐ PCs on my local network

☒ PCs on my local network, and PCs on the Internet

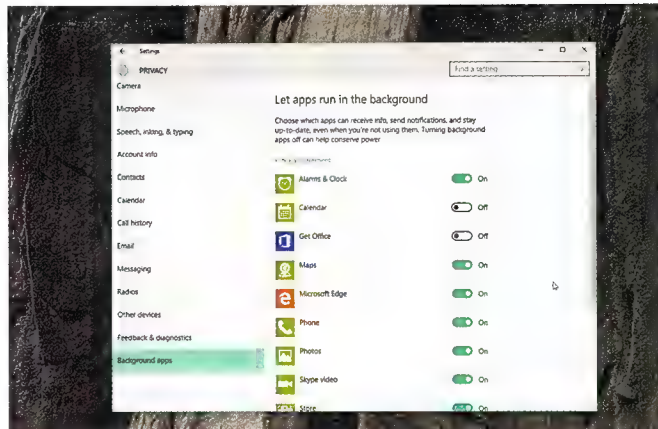
7 BANDWIDTH PRACTICE

Head back to the settings screen and go to 'Update & Security'. From the Windows Update tab, click 'Advanced options', then 'Choose how updates are delivered'. Here, you'll find a toggle switch for Microsoft's new peer-to-peer update sharing service, which uses your Internet connection to send updates to other Windows 10 users. Switch it off for a little more Internet speed.



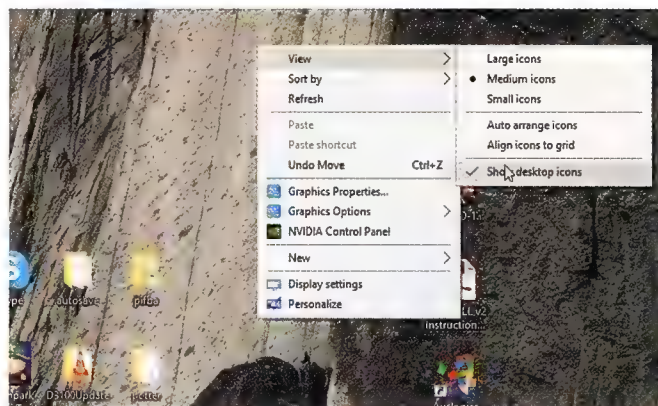
9 ENTER THE CLEANER

Our final bit of housecleaning involves an old favourite third-party program, CCleaner Free, which you can download from www.piriform.com/ccleaner. Not only is it great at scouring away the unwanted stuff lurking beneath Windows 10, you can also use it to do away with those useless apps that Microsoft insist must remain installed.



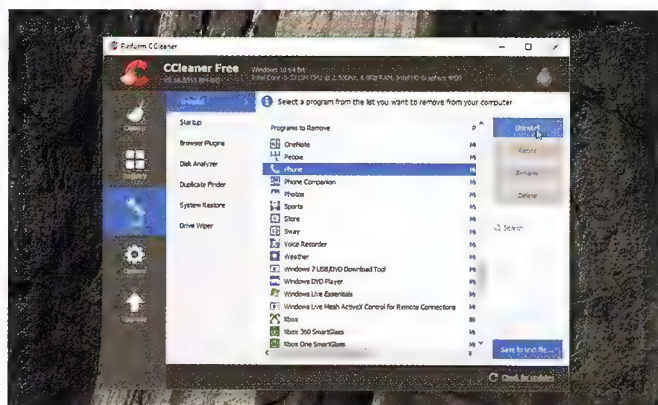
6 BACKGROUND BOTHER

Now let's search for a little more performance. While, earlier, we switched off auto-running third-party apps, Microsoft also automatically runs some of its own apps in the background. Click the Start, Settings, Privacy or Background apps to see the list, and use the toggle switches to disable them. This has the benefit of reducing a few of Windows 10's more pestering pop-ups.



8 HIDING ICONS

If you're like us, you have a messy desktop cluttered with files and icons. There's no need to delete them all — you can clean up that desktop to just your wallpaper in a couple of clicks. Right-click an area of empty space, go to the View menu and deselect 'Show Desktop icons'. When you need to see your stuff again, view it through File Explorer or reverse the process.



10 A FULL CLEAN

In CCleaner's tools tab, seek out the built-in Windows 10 apps you wish to remove, click them, then click 'Uninstall'. Be careful, as you can remove semi-essential tools like the Windows Store and it's very difficult to replace them later on. Finish off by running CCleaner's 'Cleaner' function (select it in the left menu) to wipe away just about everything we haven't already covered. ■

Keeping users informed: VBA message boxes

Download the macros for this story at www.apcmag.com/magstuff.

Helen Bradley explains three different methods for sending messages to your users in your macros.

A message box is the tool of choice when you need to pass information to your user. Message boxes are easy to code and they do a good job in most routine circumstances. However, there are times when a custom solution is required, so this month, we'll look at VBA message boxes and what to do when they aren't what you need.

BUILT-IN MESSAGE BOXES

A simple way to pass information to your user is via a VBA message box. When you need to provide information but not get anything in return, you can use a simple statement like this:

```
Sub DisplayDate()  
MsgBox "Today is: " &  
Format(Date, "dd mmm yyyy"), _  
vbInformation + vbOKOnly, _  
"Today's Date"  
End Sub
```

This message box provides today's date to the user and it stays open until the user clicks the OK button to close it and continue.

This second type of message box records a reply from the user in the form of a value representing the button the user presses to close the message box. You can offer your user choices including 'Yes', 'No', 'Cancel', 'OK', 'Abort', 'Retry' and 'Ignore'. You must declare

and use a variable in which to store the user's response so you can check it and proceed accordingly.

This is a typical message box of this type:

```
Sub RespondToUser()  
Dim userReply As Integer  
userReply = MsgBox("Shall I  
enter Today's Date into Cell  
A1?", _  
vbYesNo, _  
"Optional Date Entry")  
If userReply = vbYes Then  
Range("a1").Value =  
Format(Date, "dd mmm yyyy")  
End If  
End Sub
```

CUSTOM MESSAGE BOX

When you need to provide frequent information to a user, a message box is cumbersome because it requires the user to click a button to continue. In this situation, you can use a custom-designed form that looks like a message box. If displayed in the modal state, the form stays visible as you work and can be updated with new information without requiring user interaction. It can also display custom button text. To see this at work, create a form with a Label, a textbox and a CommandButton. Set the textbox BackColor to 'Button Face' and its SpecialEffect to '0-fmSpecialEffectFlat'. Set the

CommandButton Cancel property to 'True' and its Caption to 'Stop Counting & Exit'.

Enter this in the form code:

```
Private Sub CommandButton1_  
Click()  
Unload Me  
End Sub
```

```
Private Sub UserForm_  
Initialize()  
Me.TextBox1.Text = CStr(0)  
End Sub
```

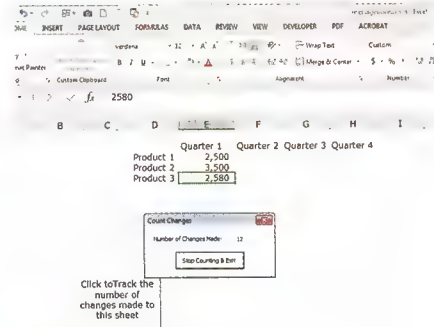
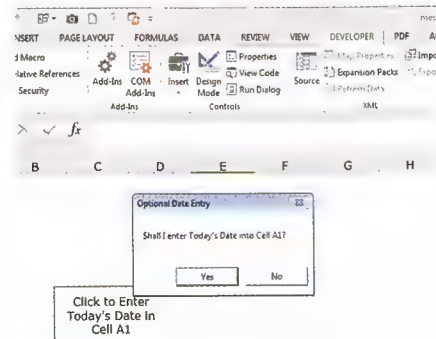
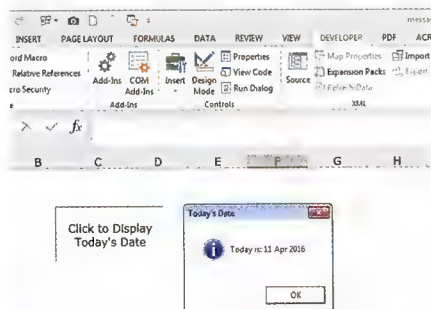
Enter this in the code window for Sheet1:

```
Private Sub Worksheet_  
Change(ByVal Target As Range)  
UserForm1.TextBox1.Value  
= CStr(UserForm1.TextBox1.  
Value + 1)  
End Sub
```

Enter this in a module:

```
Sub startTracking()  
UserForm1.Show (modal)  
End Sub
```

When you run the startTracking macro, a message box appears which displays a live ongoing count of the changes made to the current sheet. It could, of course, be programmed to display anything you like.



1 STEP 1
This simple message box delivers information but receives nothing in return.

2 STEP 2
This message box allows for interaction so the user can make a choice about how to proceed.

3 STEP 3
This custom solution is a form that stays visible, is updated as you work, and requires no user input. ■

Get to grips with iOS 9.3's best new features

Discover the improvements Apple just made to your touchscreen device with Alan Stonebridge.

Don't be fooled into thinking that iOS 9.3 has little to offer on the grounds of its relatively small bump in version number. Yes, it fixes and tweaks some existing features, but it also adds some significant new ones to your iPhone, iPod touch or iPad as well.

Its headline feature is Night Shift, which reduces the amount of blue light emitted by your device's screen. Research says this kind of light disrupts your circadian rhythm and your sleep quality. The idea of counteracting this has been around for a long time on PC and Mac, in the form of f.lux (free, justgetflux.com). Learn how to use Night Shift in iOS below.

If you have an iPhone 6s or 6s Plus, more of iOS's built-in apps offer 3D Touch shortcuts when you press firmly on their Home screen icons. The most

notable of these is Settings, which provides shortcuts to its Battery, Wi-Fi and Bluetooth pages. The App Store now has an 'Update All' action that takes you directly to its Updates page and starts downloading whatever is available in your queue – though we've found that, sometimes, the process fails to start.

Apple's ebook reader, iBooks, now plays nicer with things in ePub or PDF format that you've bought from places other than the iBooks Store. The app can now sync those items between all of your devices over iCloud. However, you still can't annotate PDFs, so you may prefer to stick with an app such as PDF Expert (\$14.99, readdle.com) if you need that.

You're now able to redownload your past purchases of audiobooks, and they're eligible for Family Sharing too.

TAKE NOTE

Notes already became far more capable in iOS 9.0 with the ability to add checklists, sketches, media and other items. Now you can lock individual notes too, and later gain access to them using a password or Touch ID. (The former method is also available in OS X 10.11.4.) There are new sorting options for arranging your notes, and new shortcuts to help you start a new sketch or checklist, as well.

There's a lot more to discover in iOS 9.3, including improvements to Health and News, sharing Live Photos with Macs using AirDrop or Messages, enhanced support for hardware keyboards, and the ability to pair multiple Apple Watches with a single iPhone. We'll walk you through the most important features, but check the full list at bit.ly/ios9info as well.

How to feel more rested by using Night Shift

Night Shift automatically shifts the colours of your display to the warmer end of the colour spectrum after dark. This may help you get a better night's sleep.

Scheduled



From 22:00
To 07:00

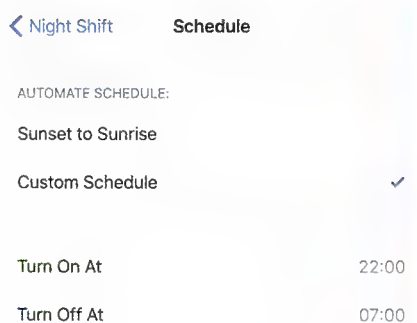
Manually Enable Until Tomorrow

COLOUR TEMPERATURE

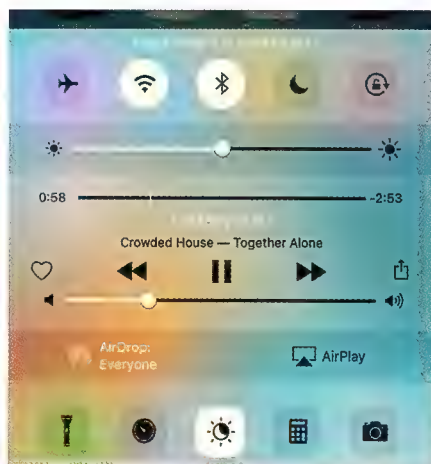
Less Warm

More Warm

1 SET A COLOUR TEMPERATURE As you adjust the slider in 'Settings > Display & Brightness', the screen's colour previews how things will look when Night Shift kicks in. The difference will seem extreme at first, so give yourself a couple of days to adjust before changing this.



2 SCHEDULE NIGHT SHIFT Night Shift is usually active between sunset and sunrise, or you can tell it to switch on between times you want: turn on the Scheduled switch, tap the 'From/To' row, select 'Custom Schedule', then dial in your desired times below that.



3 MANUALLY ENABLE IT As you adjust to using Night Shift, you may find things are harsh to look at ahead of sunset or your scheduled start time. Though you can manually turn it on in its Settings page, there's a shortcut in Control Centre to save you going there.

How to add an extra layer of security to your notes

Choose which account Siri uses when creating notes.

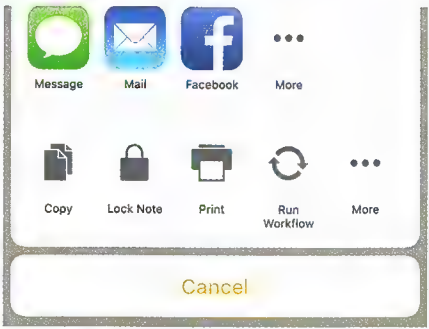
Password

Save Media to Photos

Save photos and videos taken in Notes to the Photos app.

"On My iPhone" Account

Using an "On My iPhone" account allows you to store notes on this device. Your other notes won't be affected.



Reset Password

This allows you to create a new password for notes you lock from now on. Notes that already have a password aren't affected

1 SET UP A PASSWORD
In 'Settings > Notes', tap 'Password' and enter one to use with this app only. You can set a reminder (Apple can't help with a forgotten password), and allow access using Touch ID. Note that *anyone* registered to use it can unlock notes.

2 PROTECT A NOTE
Open a note, tap the Share icon and choose 'Lock Note'. You can't protect notes that have audio, video, a PDF or an iWork document attached, however. Locking is available for notes stored on your device or in iCloud, but not other account types.

3 RESET THE PASSWORD
When you unlock a note, *all* of them become accessible until you tap the lock icon, force the app to close, or lock your device. Changing the password updates notes protected by the old one. Resetting it leaves them alone, in case you recall it.

How to take greater control of your music library

< Settings Music

Add Playlist Songs to My Music

Apple Music songs you add to your playlists will also be added to My Music.

Subscribe to iTunes Match

Store all your music in iCloud. Learn more.

PLAYBACK



For those who have already fallen under her spell, singer/songwriter Neko Case's voice is a wonder. So when the fluttering guitar at the beginning of "This Tornado Loves You" more

Shuffle

* 1	This Tornado Loves You	3:19	...
2	The Next Time You Say "Forever"	1:44	...
* 3	People Got a Lotta Nerve	2:31	...
4	Polar Nettles	2:24	...

1 AVOID LIBRARY CLUTTER
Adding a track from Apple Music to a playlist also adds it to your library. This is avoidable thanks to a new item in Music's settings: switch off 'Add Playlist Songs to My Music' in 'Settings > Music'. There's an equivalent setting in iTunes on the Mac.

2 GO TO AN ALBUM
At the Now Playing screen, you can tap the track's name to go straight to the album it's from. This is especially handy if you're listening to a 'radio' station and it throws up a track by an artist or from an album you're unfamiliar with.

3 POPULAR TRACKS
With so many albums for you to investigate, Apple Music now displays a star next to popular tracks in its library, helping you to identify good starting points for artists or albums of which you have little or no knowledge.

Improvements to photo editing

Duplicating photos affords more experimentation.

The Photos app now grants you the ability to make multiple versions of the same photo on an iOS device, perhaps because you want to try out several photo filters or even just minor variations of the same one. Open an individual photo, or select more than one if you want to create copies of several at once, then tap the Share icon and choose 'Duplicate' from the sheet's bottom row. This also enables you to edit the still part of a duplicated Live Photo and retain the original with its moving part, where before you had to abandon changes to a Live Photo to watch its video. ■

Master groups in OS X's Contacts app

Use contact information more effectively by setting up automated groups. Craig Grannell shows you how.

The idea of creating groups of digital objects is as old as the Mac itself, but manual organisation can be time-consuming and inefficient. A cleverer method is to use so-called 'smart' collections, such as Smart Folders in Finder, Smart Playlists in iTunes, or Smart Mailboxes in Mail.

In the Contacts app, this idea is realised as Smart Groups. Rather than manually adding people to a group of contacts, Smart Groups are populated according to which of your contacts match conditions you specify. Their contents even update as you change details stored about people. So if you have a Smart Group based on a surname and add a new contact with that surname, that person will be added to the Smart Group.

In fact, Smart Groups can contain multiple conditions, each looking at

different bits of information attached to your contacts. So as well as someone's name, a Smart Group might check company names, the domain name of company websites, cities and much more. Along with the aforementioned group that could be used for contacting family, you could create one based on a location, or for each of your contacts at a specific company.

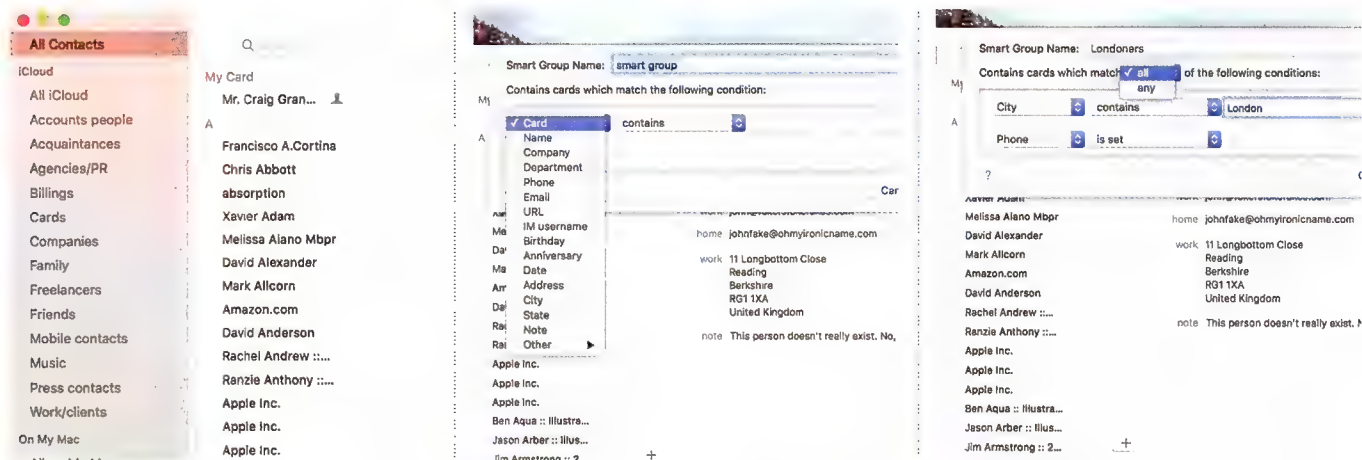
This is particularly helpful in Mail. When you type a group's name in the 'To' field and press Enter, the group's name is replaced by the contacts in that group, which you can amend as appropriate for the message you're writing. Using a Smart Group means there's less chance of someone being missed out, because the recipients will be based on current info stored in Contacts. Even within the Contacts app, Smart Groups can be useful for quickly

working your way through a specific list of people you need to call or send something.

SMARTLY PLUG INFORMATION GAPS

In the walkthrough, we provide ideas for Smart Groups that can save you time. In some cases, we'll be working with the app's Note field, which allows you to add arbitrary information. When doing so, try to be consistent. If you use this field to list people's children, say, don't prefix it with 'Children:' in some contacts and 'Kids:' in others, because you'll have to search for both in a Smart Group's conditions. Also, to differentiate Smart Groups from normal ones, and to speed things along in Mail, consider adding a character to the start of every Smart Group's name, such as '@Surname' rather than plain old 'Surname'.

How to make your first Smart Group



1 GET STARTED

Ensure that the Groups sidebar is open (if it isn't, choose 'View > Show Groups' or press Command-1). You'll see existing groups from your iCloud account below, which will be the Smart Groups section only if you've already defined a Smart Group.

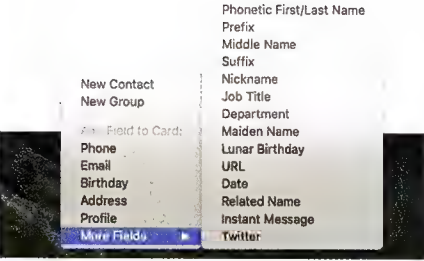
2 CREATE A SMART GROUP

Choose 'File > New Smart Group'. In the sheet that appears, name the group, then use the controls below to select an attribute and specify a value, and how contacts must match the two in order to be included in the group.

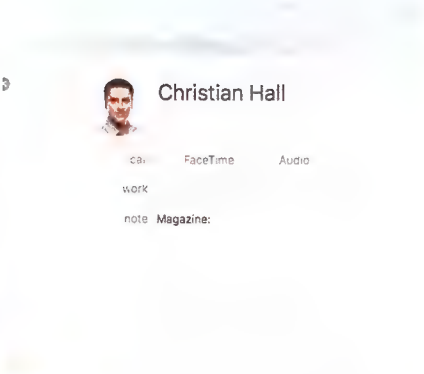
3 MAKE COMPLEX MATCHES

Click the + to the right of the rule to add an extra criterion. On doing so, a new pop-up menu appears above the list of criteria. Use it to determine whether the Smart Group should match all or any (at least one) of your specified conditions.

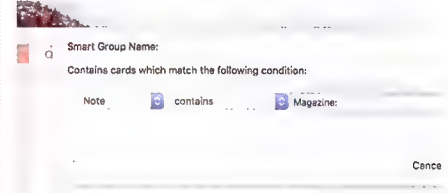
How to use notes with Smart Group



1 THINK OF AN ATTRIBUTE
Select a contact and click the + under its details on the right. Note the extra fields that are available to add to it. Think of a way you'd like to group people that isn't addressed by these fields, then click inside your contact's Note field.

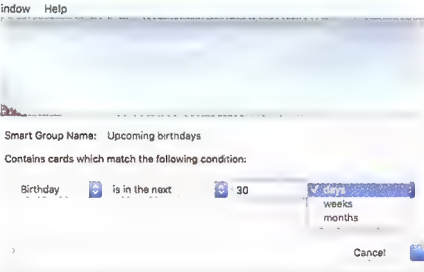


2 ADD IT TO THE NOTE FIELD
We're going to create a group for APC magazine. For each contact we want to include, we add to the Note field 'Magazine' (without quotes). You can type anything, but be consistent with wording and grammar.

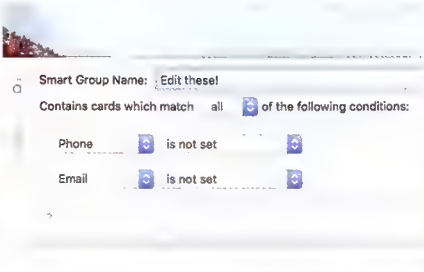


3 GROUP BY NOTE CONTENTS
Make a Smart Group, set it to check that the Note field contains the same text you used in Step 2, then click 'OK'. You could adapt this to group friends who also have children to make the task of sending out party invitations easier, for example.

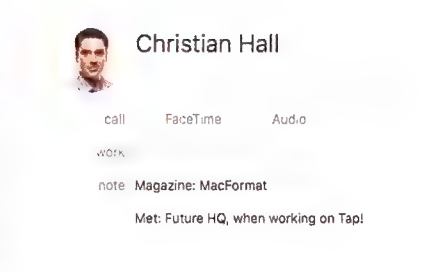
How to be more organised



1 MAINTAIN A BIRTHDAY LIST
Calendar can provide birthday alerts, but a Smart Group in Contacts provides a potentially longer overview of what's coming up. Create one that checks for 'Birthday is in the next' and a duration that suits how much warning you need!



2 UNEARTH MISSING DETAILS
It's easy to end up with an address book that isn't that useful. Create Smart Groups to list contacts lacking important details (email addresses, phone numbers, etc), then get cracking with filling in the missing information.



3 RECALL WHERE YOU MET
If you acquire contacts at speed, use the Note field to state where, when and why you met someone. Periodically create a Smart Group that finds contacts that lack this information and use it to prune your records accordingly.

What about iOS?

How to (sort of) get Smart Groups on iOS devices.

For reasons known only to Apple, Smart Groups don't sync to iOS and you can't create Smart Groups on an iPhone, iPod touch or iPad either, at time of writing. A workaround for the problem is to copy items from a Smart Group into a regular one on your Mac, which will sync to iCloud and be accessible on iOS. However, there is a way to make and edit Smart Groups on iOS: go to **iCloud.com** in Safari, tap the Share icon, choose 'Request Desktop Site', sign in and tap 'Contacts'. Your iPhone must be in portrait orientation to see the + at the bottom of the sidebar. ■



Working with files in the Linux terminal

Nick Peers flexes his fingers and dives head-first into the inky darkness of the terminal to show you how to start handling the commands.

The terminal is an incredibly important part of your Linux desktop. It doesn't matter how wedded you are to point and click over the command line, at some point, you're going to have to dip your toe in the terminal's dark expanse and use it. Don't worry, though, because the terminal isn't as scary as it might appear, and if you take the time to learn the basics, you'll discover it can be a far quicker and more effective way of getting certain tasks done.

As you'd expect, a terminal effectively gives you access to your Linux shell, which means it works in exactly the same way using the same language (Bash). This means you can do anything in the terminal you'd normally do at the command line, all without leaving the relative comfort of your desktop. That makes learning how to use the terminal – and Bash – doubly advantageous, as it gives you your first glimpse into working with the underlying Linux shell. And over the next few articles, that's exactly what you're going to learn – how to get to grips with the terminal.

We're basing this tutorial on Ubuntu, so start by opening the Dash and typing "terminal" into the search box. You'll find the terminal, of course, but you'll also see two entries called 'UXTerm' and 'XTerm', too. This highlights the fact

there are multiple terminal emulators that you can run in order to interact with the shell. There are differences between them, of course, but they fundamentally do the same thing.

For the purposes of this tutorial, we're sticking with the default terminal, which is basically the 'gnome-terminal' emulator – technically, it's emulating a TeleTYpe (TTY) session. It has all the functionality you'll need, but both XTerm and UXTerm are worth noting because, although they are more minimalist tools, neither require any dependencies to run. This means if anything stops the main terminal from running, you can use either as a backup. As an aside, the only difference between the two is that UXTerm supports the expanded Unicode character set.

HOW BASH WORKS

The Linux shell uses the Bash shell and command language to perform tasks, and it uses a relatively straightforward syntax for each command: `utility command -option`.

The 'utility' portion of the command is the tool you wish to run, such as `ls` for listing the contents of a directory, or `apt-get` to trigger the APT package management tool. The `command` section is where you specify exactly what you want the

Speed up text entry

It doesn't matter how fleet of hand your typing skills are, the command line can still be a time-consuming, frustrating experience. Thankfully, the terminal comes equipped with lots of handy time-saving shortcuts. This issue, let's take a look at how you can easily access previously used commands and view suggestions:

- **Up/down arrows** Browse your command history.
- **History** Use this to view your command history.
- **Ctrl-R** Search command history. Type letters to narrow down search, with the most recent match displayed, and keep pressing Ctrl-R to view other matches.
- **Tab** View suggestions or auto-complete a word or path if only one suggestion exists. Press `~Tab` to autofill your username, `@Tab` to autofill your host name and `$Tab` to autofill a variable.

```
apt-get [options] install|remove pkg1 [pkg2 ...]
apt-get [options] source pkg1 [pkg2 ...]

apt-get is a simple command line interface for downloading and
installing packages. The most frequently used commands are update
and install.

Commands:
  update - Retrieve new lists of packages
  upgrade - Perform an upgrade
  install - Install new packages (pkg is libc6 not libc6.deb)
  remove - Remove packages
  autoremove - Remove automatically all unused packages
  purge - Remove packages and config files
  source - Download source archives
  build-dep - Configure build-dependencies for source packages
  dist-upgrade - Distribution upgrade, see apt-get(8)
  dselect-upgrade - Follow dselect selections
  clean - Erase downloaded archive files
  autoclean - Erase old downloaded archive files
  check - Verify that there are no broken dependencies
  changelog - Download and display the changelog for the given package
  download - Download the binary package into the current directory

Options:
  -h This help text.
  -q Loggable output - no progress indicator
  -qq No output except for errors
```

The '--help' flag can be used with any command to find out what it does, plus what arguments to use.

Your first terminal commands

While it's possible to install and manage software using a combination of the Software Center and Ubuntu's Software & Updates setting panel, it's often quicker to make use of the Advanced Package Tool (APT) family of tools. Here's some key ways that they can be used (see `sudo use` below):

- **\$ apt-cache pkgnames** Lists all available packages from sources listed in the `/etc/apt/sources.list` file.
- **\$ sudo add-apt-repository ppa:<repository name>** Adds a specific Launchpad PPA repository to the sources list.
- **\$ sudo apt-get update** Gets the latest package lists (including updated versions) from all listed repositories.
- **\$ sudo apt-get install <package>** Installs all the named package. This will also download and install any required dependencies for the packages.
- **\$ apt-get remove <package>** Use this to remove an installed package. Use **apt-get purge <package>** to remove all its configuration files and **apt-get autoremove** to remove packages installed by other packages that are no longer needed.
- **\$ sudo apt-get upgrade** Upgrades all installed software — run **sudo apt-get update** before running this. Other useful ‘apt-get’ commands include **apt-get check**, a diagnostic tool that checks for broken dependencies, and **apt-get autoclean**, which removes Deb files from removed packages.

```
nick@nick-ubuntu:~$ apt-cache show vlc
Package: vlc
Priority: optional
Section: universe/graphics
Installed-Size: 3765
Maintainer: Ubuntu Developers <ubuntu-devel-discuss@lists.ubuntu.com>
Original-Maintainer: Debian Multimedia Maintainers <pkg-multimedia-maintainers@lists.d.o.s>
Architecture: amd64
Version: 2.1.6-0ubuntu14.04.1
Replaces: vlc-data (<= 1.1.5), vlc-nox (<= 2.0.2)
Provides: mp3-decoder
Depends: fonts-freefont-ttf, vlc-nox (= 2.1.6-0ubuntu14.04.1), libaa1 (>= 1.4p5), libasound2 (>= 0.9.2), libatomic1 (>= 4.8.1), libbsd-dev (>= 0.19.2), libcdio-paranoia1 (>= 3.9.2), libcurl4 (>= 7.28.0), libdbus-1-3 (>= 1.10.2), libdca (>= 0.0.1), libdv (>= 1.0.0), libdvbpsi (>= 0.10.0), libeudev (>= 2.3.1), libexif (>= 0.6.21), libfreetype (>= 2.1.1), libgdbm (>= 1.8.3), libgnutls28 (>= 3.4.10), libgsm1 (>= 1.0.13), libidn (>= 1.3.3), libjpeg-turbo (>= 1.2.9), libkate (>= 0.2.2), liblame (>= 0.4.2), libmad0 (>= 0.15.9b), libmatroska (>= 0.7.1), libmicrohttpd (>= 0.4.0), libmpeg2 (>= 0.4.0), libmpcdec (>= 0.1.6), libmpfr (>= 3.1.2), libmpeg2encpp (>= 0.4.0), libmtp (>= 0.19.0), libncurses (>= 5.9), libogg (>= 1.3.2), libopenal (>= 1.18.0), libopenmpt (>= 0.2.1), libopus (>= 1.2.1), liborc (>= 0.4.15), librtmp (>= 0.1.7), libshout (>= 2.4.2), libspeex (>= 1.2.0), libssh (>= 0.7.2), libssl (>= 1.0.1), libtag (>= 1.11.1), libtheora (>= 1.1.1), libtiff (>= 4.0.3), libvorbis (>= 1.3.6), libvorbisidec (>= 1.0.2), libvpx (>= 1.2.0), libx11 (>= 1.6.3), libxcb-composite0 (>= 1.0.3), libxcb-keysyms1 (>= 0.3.9), libxcb-render0 (>= 1.0.3), libxcb-shm0 (>= 1.0.3), libxcb-xfixes0 (>= 1.0.3), libxext (>= 1.3.3), libxinerama1 (>= 1.1.3), libxrandr (>= 1.5.0), libxss1 (>= 1.2.3)
Pre-Depends: dpkg (>= 1.15.6-)
Recommends: vlc-plugin-notify (= 2.1.6-0ubuntu14.04.1), vlc-plugin-pulse (= 2.1.6-0ubuntu14.04.1), vlc-plugin-sdl2 (= 2.1.6-0ubuntu14.04.1)
Suggests: videolan-doc
Breaks: vlc-data (<= 1.1.5), vlc-nox (<= 2.0.2)
Filename: pool/universe/v/vlc/vlc_2.1.6-0ubuntu14.04.1_amd64.deb
Size: 1221144
MD5sum: fbb2933ada01d9ccdd319dde21bd89
SHA1: 4bb0e71315956d07ce18b6d77eeb27ee1b968fbe
SHA256: 636992ae393297dd5afda39b9cb3ab98583df246e51ad7668cc3f5993ca35f
Description-en: multimedia player and streamer
```

The apt-cache package can also be used to search for specific packages or reveal a package's dependencies.

utility to do – e.g. typing `apt-get install` instructs the package management utility to install the named package: `apt-get install vlc`.

The **-option** section is where one or more 'flags' can be set to specify certain preferences. Each flag is preceded by one or two dashes (--) and the most useful of all is the **--help** option, which provides a brief description of the utility, plus lists all available commands and options, e.g.

The `-l` flag tells the list directory tool to provide detailed information about the contents of the folder it's listing, including permissions, who owns the file, the date it was last modified and its size in bytes. Utilities can be run without any commands or options – e.g. `ls` on its own provides a basic list of all folders and files in a directory. You can also run utilities with a combination of commands and/or options.

RESTRICTED ACCESS

Open the terminal and you'll see something like this appear:

`username@pc-name:~$`. This indicates that you're logged on to the shell as your own user account. This means that you have access to a limited number of commands – you can run `ls` directly, for example, but not to install a package using `apt-get`, because the command in question requires root access. This is achieved one of two ways – if you're an administrative user, as the default

user in Ubuntu is, then you can precede your command with the `sudo` command: `sudo apt-get install vlc`. You'll be prompted for your account password, and then the command will run. You should find that you can run more `sudo`-based commands without being re-prompted for your password (for five minutes) while the terminal is open. On some distros, you can log on to the terminal as the root user with `su` – you'll be prompted for the root password, at which point, you'll see the following prompt: `root@pc-name:~#`.

Once logged in, you can enter commands with no restrictions. We recommend you use the `sudo` command rather than this approach, and if you're running Ubuntu, then you'll find `su` won't work because the root account password is locked for security reasons.

When installing some distros or adding new users to Ubuntu, you may find that your user account isn't added to the `sudo` group by default. To resolve this, you need to open the terminal in an account that does have root access (or use the `su` command if supported) and type `sudo adduser <username> sudo`. You can also add the user to other groups with the command by listing all the groups you wish to add, for example: `sudo adduser <username> adm sudo loadadmin sambashare`.

Another handy tool is 'gksudo', which allows you to launch desktop applications with root privileges. It's of most use when wanting to use the file

manager to browse your system with root access: `gksudo nautilus`. Make sure you leave the terminal open while the application is running, otherwise it'll close when the terminal does. When you're done, close the application window, then press Ctrl-C in the terminal, which interrupts the currently running program and returns you to the command line.

We've already discussed the `--help` flag, but there are other help-related tools you can use, too. First, there's `whatis` — which you can type with any command to get a brief description of it and any specified elements:

```
whatis apt-get install vlc
```

will describe the `apt-get` tool, the `install` argument and what package `vlc` is. Flags are ignored.

If you're looking for a full-blown manual, then the `man` tool provides access to your distro's online reference manual, which is started with `man intro`. This provides you with a long and detailed intro to the command line. Once done, press `Q` to quit back to the terminal. For more advice on navigating the manual, type `man man` or pair it with a tool, e.g. `man ls`.

Now you've taken your first steps into the world of the terminal, check out the box 'Your first terminal commands', above, for some useful package management commands you can work with. Next issue, we'll look at how to navigate your filesystem from the terminal, plus launch programs and delve into more useful shortcuts to help speed up the way you interact with the command line. ■



Make a furiously-fast Core i5 desktop PC

Alex Campbell reckons it's time to prove you can get some impressive performance from a locked quad-core.

If there's one thing we love to have in a build, it's an unlocked CPU. While we don't always overclock our published builds, it's hard to overstate the value that some get from overclocking. There's the 'free' upgrade, the satisfaction of customising and tweaking something yourself, and the thrill of pushing a CPU to its limit.

But not everyone needs to overclock. Most people will never enter the UEFI BIOS, let alone risk voiding a warranty on a part that costs \$250 or more. There's another price of overclocking, too. K-model CPUs are more expensive than their locked counterparts. For a first-time builder or someone on a budget, it's difficult to justify buying a K-model CPU when a locked model

does most of the stuff you need it to do. That's not to say you can't get great performance from a locked CPU.

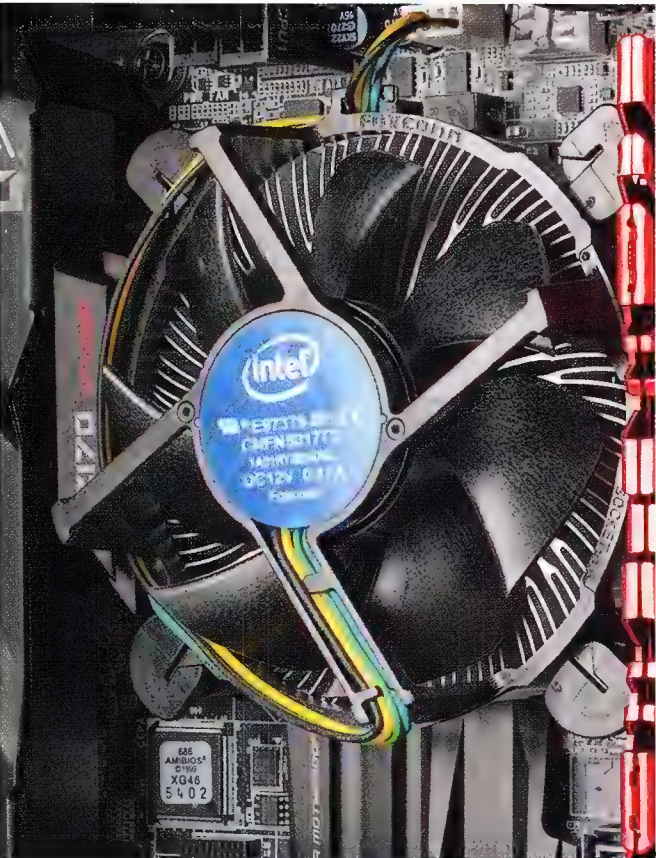
In this build, we set out to assemble a machine that called upon the Core i5-6500, a locked quad-core that's fairly inexpensive. We found that this CPU – the Skylake successor to the Haswell i5-4570 – can still get the job done.

ALL IN ON GRAPHICS

One of the things we wanted to test in this build was how a high-end GPU would perform with the humble Core i5-6500. We picked the ASUS R9 Fury Strix to push pixels in this build, and complemented the system with 8GB of DDR4 RAM. We installed our CPU, GPU, and RAM on to an EVGA Z170 Stinger mini-ITX motherboard. The Stinger was one of the first Skylake motherboards we got our hands on, but it's been spending its days on a shelf in the office. We took it from its hiding spot and pressed it into service. For storage, we turned to one of our favourite SSDs: the 250GB Samsung 850 Evo. With impressive speed and a decent price, the 250GB Evo really is a great base for any PC. This particular SSD was the 2.5-inch model, which we've been trying to wean ourselves away from, opting instead for the M.2 form factor. Unfortunately, not every motherboard supports M.2 – while the Stinger does support M.2, it only has room for the shortest of M.2 cards, which we feel is aimed at Wi-Fi expandability, rather than storage. We put all of these parts into NZXT's new Manta mini-ITX case, which we reviewed in APC 427 (see page 27).

PARTS LIST

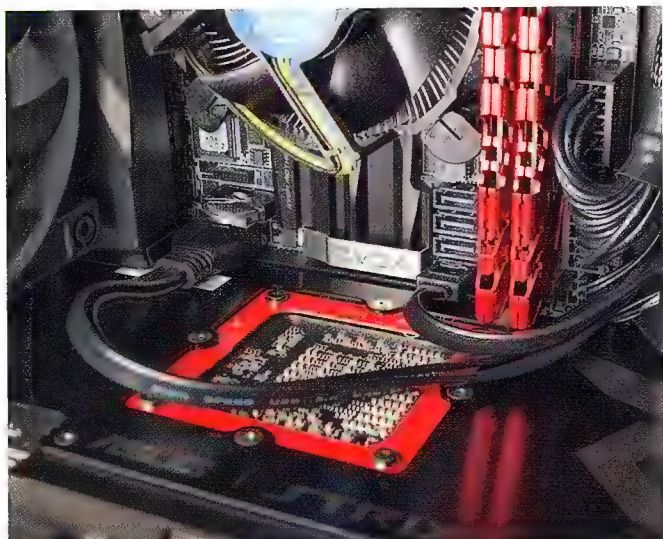
PART		STREET PRICE
CASE	NZXT MANTA	\$209
MOTHERBOARD	EVGA Z170 STINGER ITX	\$330
CPU	INTEL CORE I5-6500	\$295
MEMORY	8GB (2X 4GB) G.SKILL RIPJAWS 4 SERIES DDR4-2133	\$71
GPU	ASUS R9 FURY STRIX	\$799
PSU	EVGA SUPERNOVA NEX 650W 80 PLUS GOLD	\$139
SSD	SAMSUNG 850 EVO 250GB	\$129
TOTAL		\$1,677



1 BASIC COOLING One of the bad things about getting a K-model Skylake CPU is that you're forced to buy a cooler of some sort. The Core i5-6600K and the i7-6700K both come without heatsinks or fans in the box, so the onus is on the builder to make sure the chips don't overheat. The Core i5-6500 doesn't have that problem. Intel's stock heatsinks and fans are made by Foxconn (if you look closely, you can see the parts stamped with Foxconn's name). They're far from sexy, but they're effective, low profile and don't consume much power. And if you're building a PC with a locked CPU, there's really no compelling reason to go out and spend money on a bigger heatsink. Using the stock heatsink and fan also saves time, because installation takes all of about 15 seconds, provided everything is done correctly.

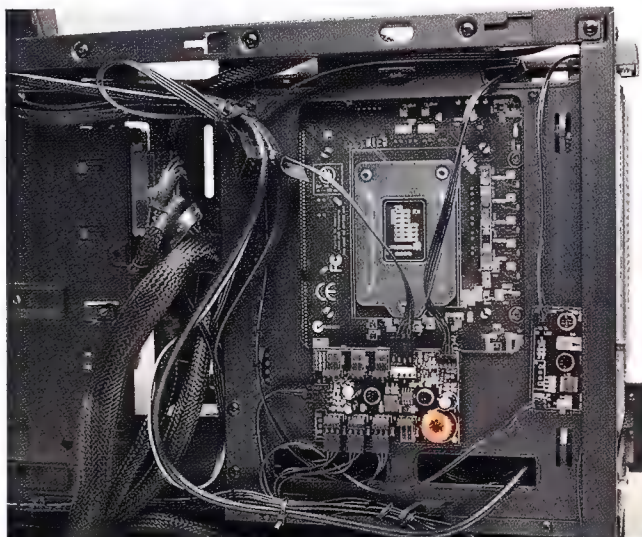


2 ROOM FOR THE BIG GUYS The ASUS R9 Fury Strix is a big card, and using it in a mini-ITX build can sound counter-intuitive. The typical logic that a mini-ITX build means using a small, underpowered card didn't hold true with the Manta. The front of the Manta actually had plenty of room to spare, which gives us confidence that using a big card such as the Fury Strix with a thick radiator wouldn't pose much of a problem. The front of the Manta comes off easily, allowing for easy fan and radiator mounting. The two fans you see here come pre-installed, which offers plenty of airflow for the Fury and our air-cooled CPU. It's a good thing, too, because the video card sits just above a partition for the PSU and hard drives. Without plenty of cool air being forced over the card, pulling cool air in from that relatively tight space could be a little tougher.



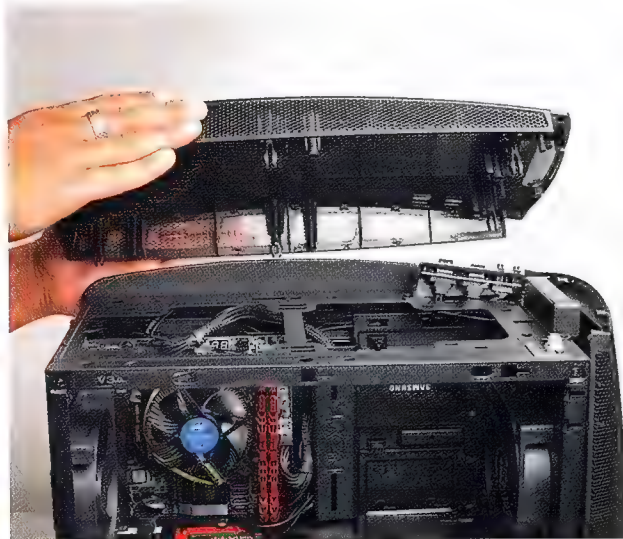
3 RUNNING CABLES

If there's one thing that will frustrate a builder in a mini-ITX system, it's the location of SATA and USB 3.0 connectors. When connecting the cables for this rig, we were forced to run them over the top of the RAM DIMMs. While this isn't a big deal, having a clean-looking motherboard compartment is half the reason people buy cases with windows. They don't want to see clutter; they want to see their components in all their glory. We had to curb our obsessive-compulsive need for a totally clean presentation for the sake of functionality. After all, the machine has to boot, right? And two little cables are far from the worst offenses when it comes to presentation. It's also worth noting in this photo that the Fury Strix's backplate looks quite nice in this case, and serves to help camouflage the cables slightly.



5 NOT SUCH AN UGLY SIDE

Astonishingly, the Manta accommodates cabling quite well, without the need for excessive tie-downs. If you look closely, you might notice that our big, fat power cables aren't actually tied down to anything. Instead, they sit in a channel that's beveled out into the motherboard compartment. Holes on either side of the channel offer access to the motherboard, while big cables have a roomy place to call home. The backplate you see actually came from a Gigabyte H170 board. The Z170 board came with a backplate that had arms reaching out to each of the CPU cooler's mounting holes, with a threaded screw hole near the tip of each arm. The stock cooler's prongs couldn't be fitted into the threaded holes, so we had to go with another backplate.



4 HATS OFF

We already mentioned that the Manta has plenty of room up front for a radiator and fans, but it would be a shame to leave out what the Manta offers up top. The top of the case is easily removed with a few round tabs found inside. It was only after we tried putting the top back on that we realised that taking off the front panel makes removing the top much, much easier. The top panel has enough space to accommodate a radiator like that found on the Kraken X61. It looks like there's room to add fans, too. Even if your radiator and fan combo is too big, you can always try hanging the radiator below the bracket and mounting the fans on top (or vice versa). One thing we noticed here was the lack of a dust screen. It's not the worst thing in the world, and we're forced to wonder where one would be added if it could have one. But having a screen is almost always preferable to not having one.



6 STEALTHY STORAGE

The Samsung 850 Evo we used for storage seems to disappear against the black interior of the Manta. We're just fine with this, because it offers a clean look and doesn't draw attention to itself right away. Upon casual inspection, one could wonder whether the system has storage at all. The Manta has two mounts for 2.5-inch drives, which sit flush against the panel that's adjacent to the motherboard tray. Using a flush mounting position not only shows off the drives, but allows for an unobstructed path for air (or water tubing) to reach the motherboard. If builders are looking for a place for a 3.5-inch HDD, the hard drive mount points are located under the PSU compartment partition.



- 1 We decided to mount the metal I/O connection cover (not to be confused with the back panel shield) for looks.
- 2 The cabling channel provides easy and clean cabling access to the motherboard and SSDs.
- 3 The Manta includes three fans (two up front, one rear) for plenty of airflow in a stock configuration.
- 4 A PSU partition helps keep the motherboard compartment looking clean and tidy.

Performance in an Attractive Package

Putting this rig together was fun and we were happy with how it all worked out. The video card looks great behind the Manta's curved window, and the clean layout made the PC something to behold.

Looks aren't everything, though, and at the end of the day, the PC has to perform. And perform it did, well, when it did.

There were several instances where the PC would reboot in the middle of a benchmark. While Windows 10 has annoyed users with silent updates and unprompted reboots, we thought it wouldn't happen in the middle of high CPU utilisation. We did eventually get through all the benchmarks, so we let it slide. If this were going to be a machine that we'd use day-to-day, we would look for a firmware update for the mobo, and hunt down the culprit.

The scores from the tests were impressive. In our visual tests, the Fury happily pushed pixels out to our screen at a healthy rate, producing playable frame rates in the two 3,840 x 2,160 titles. At 1440p, the Fury managed to top 90fps, which is pure gold for gamers with 1440p screens. We're still not totally sold on gaming on 4K monitors; if you're planning on gaming, the smart money is that you're looking at 1440p performance.

In 3DMark Fire Strike Ultra, the Fury managed a score of 3,465. The

Oculus Rift recommended spec has a score of 2,596, which easily puts this rig into Oculus-ready territory. Considering that the Oculus-recommended spec calls for an i5-4590 (with a higher clock speed than the i5-6500), we're happy with that.

When it came to timed benchmarks, the 3.2GHz quad-core wasn't going to keep up with the i7-5960X we use as a zero-point. The i5-6500 isn't the CPU you want for computational or workstation tasks, so music producers and graphics designers should go for an i7 instead.

We liked the doors on the Manta, as it had nubs that helped us align the door before securing it. However, NZXT opted for thumb screws that are meant

to stay on the doors. While this is great to prevent loss, they assume awkward angles when you're trying to secure the door closed. Having removable screws would alleviate some of these problems.

The Manta is pretty, but it's expensive. The Phanteks Enthoo Evolv we reviewed back in APC 419 (see page 30) is \$180, and offered room for full-size GPUs like the Manta. While the features of the two are different, and the Manta offers more cooling options, it is twice as expensive. It's better suited for builds that plan to do overclocking, so the cooling options can be put to good use. If you're staying stock and locked, the Enthoo Evolv might serve you better.

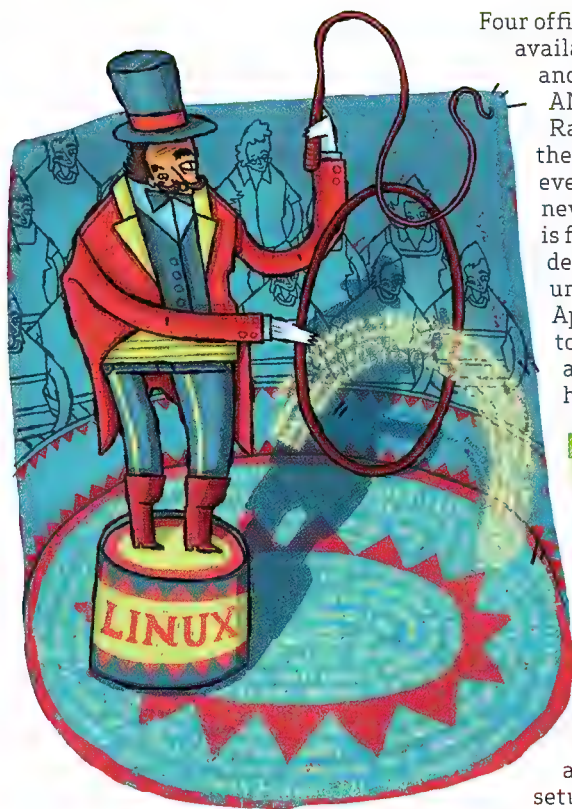
BENCHMARKS

	APC LABS TEST PC	
STITCH.EFX 2.0 (SEC)	806	832 (-3.2%)
PROSHOW PRODUCER 5.0 (SEC)	1,472	1,811 (-23%)
X264 HD 5.0 (FPS)	33.8	13.47 (-60.1%)
BATMAN: ARKHAM CITY @ 1440P (FPS)	204	92 (-55.9%)
TOMB RAIDER @ 2160P (FPS)	87.5	38.8 (-55.7%)
SHADOW OF MORDOR @ 2160P	70.1	44.73 (-36.2%)
3DMARK FIRE STRIKE ULTRA	8,016	3,465 (-56.8%)

Our desktop Labs Test PC uses a Core i7-5960X CPU, three GTX 980s, and 16GB RAM. *Arkham City* tested at 2,560 x 1,440 max settings with PhysX off; *Tomb Raider* at Ultimate settings; *Shadow of Mordor* at Max settings. ■

Build a Pi Zero media centre

Nick Peers demonstrates how to construct your own smart-streaming stick using a Raspberry Pi for both personal and Internet media.



Four official builds are currently available: 'generic' covers 32-bit and 64-bit Intel, Nvidia and AMD graphic setups; two Raspberry Pi flavours: one for the Pi 2, and the other for everything else, including the new Pi Zero; and one final build is for Freescale iMX6 ARM devices. There are further unofficial builds for jailbroken Apple TV mark 1 boxes (head to chewitt.openelec.tv/appletv), as well as AMLogic-based hardware (bit.ly/amlogic-oe).

CHOOSE YOUR HARDWARE

The cheapest way to build an OpenELEC streaming box from scratch is to base it around the Raspberry Pi Zero. There's one slight complication caused by the fact it only has one USB port, so you'll need a powered hub to support both keyboard and Wi-Fi adaptor during the initial setup phase. Expect to pay

between \$55 and \$80 for all the kit you need (not including postage) from the likes of The PiHut (www.thepihut.com) or Pimoroni (shop.pimoroni.com). You'll need a Pi Zero (obviously), case, power adaptor, Wi-Fi adaptor, microSD card, powered USB hub and accessories.

If you're willing to spend a little more, then the Raspberry Pi Model B+ costs about \$38 or the quad-core Pi 2 Model B costs approximately \$52 from au.rs-online.com, not including power and Wi-Fi adaptors, micro SD card and case. Both come with an Ethernet port for wired networking, plus four USB ports and full-size HDMI port – choose the Pi 2 if you plan to run a full media server, which requires more CPU grunt.

You'll need a keyboard for the initial configuration of OpenELEC, but once those steps are complete, you'll be able to control OpenELEC remotely via your web browser or by using a free mobile app. You'll also need somewhere to store your media. If you only have a small (sub-50GB) collection, then splash out for a 64GB microSD card and store it locally; otherwise attach a USB hard drive or even store your media on a NAS drive and connect over the network. Note the latter option will slow things down considerably, and you may experience buffering, particularly if connected via Wi-Fi.

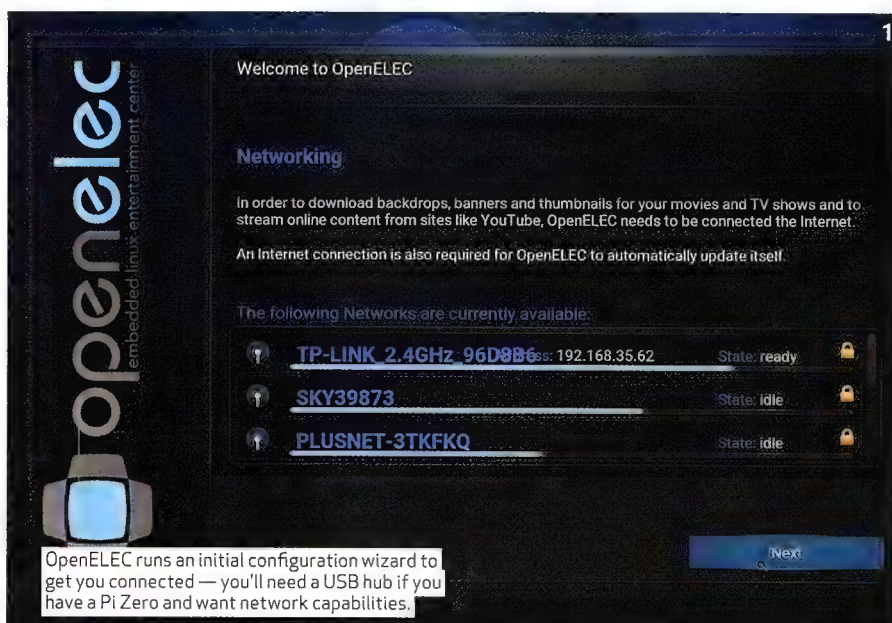
You can find both of the Raspberry Pi builds of OpenELEC (or just the generic 64-bit build if you're not using a Pi) available as free downloads from openelec.tv/get-openelec – be sure to get the latest version. The files are compressed in TAR or GZ format, so you'll first need to extract them. The simplest way to do this is using your Linux distro's GUI – in Ubuntu, for

Why fork out for an expensive set-top box when you can build your own for significantly less?

Thanks to the powerful open-source Kodi media centre software (kodi.tv), you can access both locally stored personal media on demand, plus watch a wide range of Internet streaming services, including catch-up TV.

The success of Kodi – formerly known as XBMC – has led to the development of Kodi-flavoured distributions (distros). If you're looking for a full-blown Ubuntu-based distro with Kodi sitting on top then Kodibuntu (kodi.wiki/view/Kodibuntu) will appeal.

Kodibuntu is overkill for most people's needs, which is where OpenELEC (www.openelec.tv) comes in. This is an embedded OS built around Kodi, optimised for less powerful setups and designed to be as simple to run and administer as possible. There's an underlying OS you can access via SSH, but for the most part, you can restrict yourself exclusively to the Kodi environment.



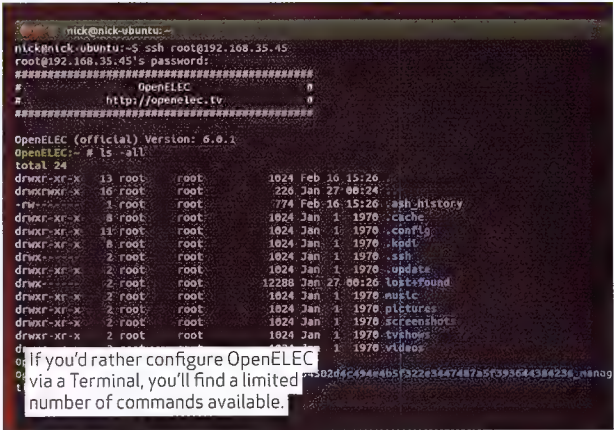
SSH access

Switch on SSH and you have access to the underlying Linux installation via the Terminal (use `ssh root@192.168.x.y` substituting '192.168.x.y' with your OpenELEC device's IP address. The password is 'openelec'). The main purpose for doing this is to configure OpenELEC without having to dive into 'System > OpenELEC'. Start by typing `ls -all` and hitting Enter — you'll see the core folders are hidden by default.

Basic commands are supported, such as `ifconfig` for checking your network settings and `top` to see current CPU and memory usage. There's not an awful lot you can do here — the idea is to give you access to useful tools only. Network settings in OpenELEC are controlled by the connman daemon, e.g. to change these, navigate to 'storage/cache/conman' where you'll find a lengthy folder name beginning 'wifi_'. Enter this folder using `cd wifi*` and then type `nano settings` to gain access.

If you'd like to set a static IP address from here, change the following lines:

```
IPv4.method=manual
Then add the following three lines beneath IPv6.
privacy=disabled:
IPv4.netmask_prefixlen=24
```



```
IPv4.local_address=192.168.x.y
IPv4.gateway=192.168.x.z
```

Replace '192.168.x.y' with your chosen IP address and '192.168.x.z' with your router's IP address (get this using the `ifconfig`). Save your changes and reboot.

example, copy the file to your hard drive, then right-click it and choose 'Extract Here'.

BUILD, INSTALL AND CONFIGURE

Now connect your micro SD card to your PC using a suitable card reader (you can pick one up for under \$10 online) and use the `fdisk` or `lsblk` command or Disks utility to identify its mountpoint. Once done, type the following commands — which assume

your drive is 'sdc' and that your image file is in the Downloads folder.

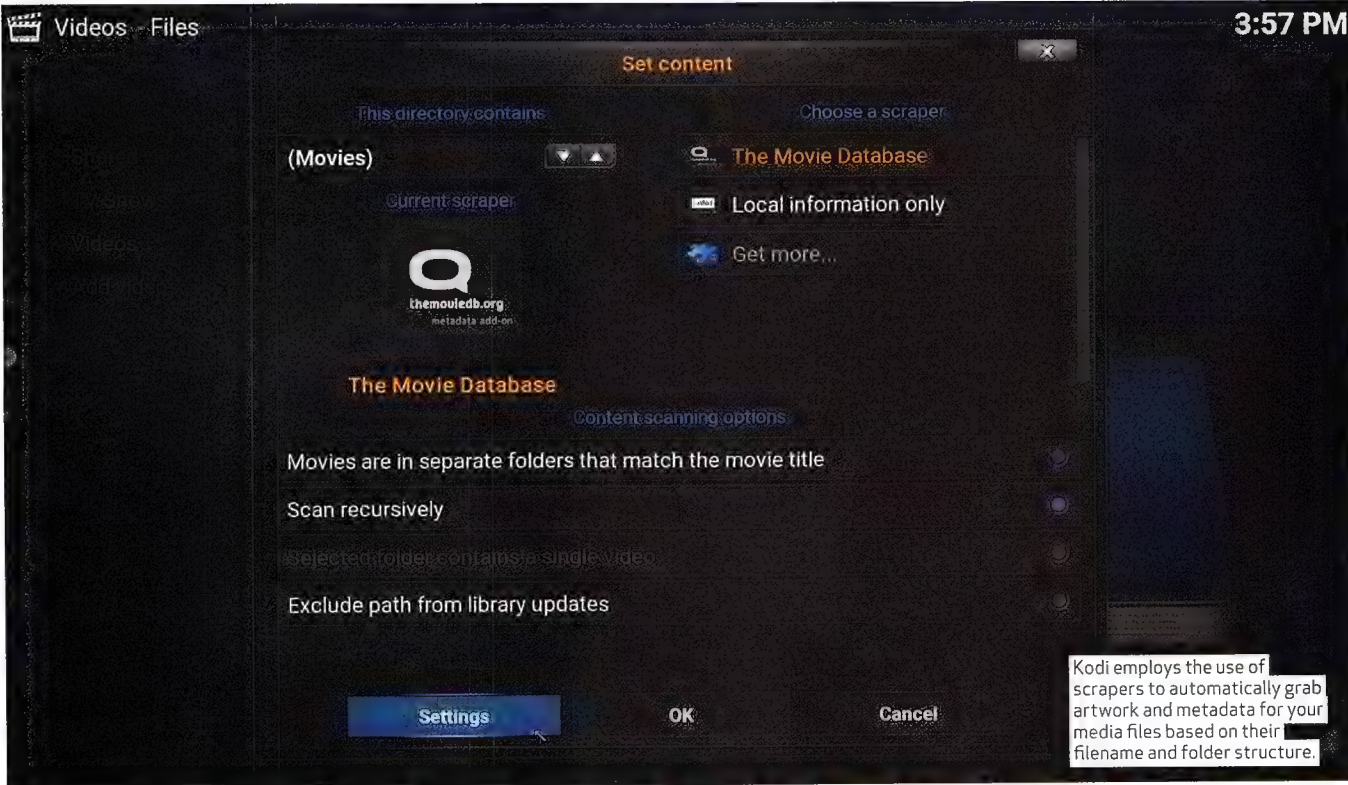
```
# umount /dev/sdc1
# cd Downloads
# sudo dd if=openELEC-RPi.arm-b.0.1.img of=/dev/sdc bs=4M
```

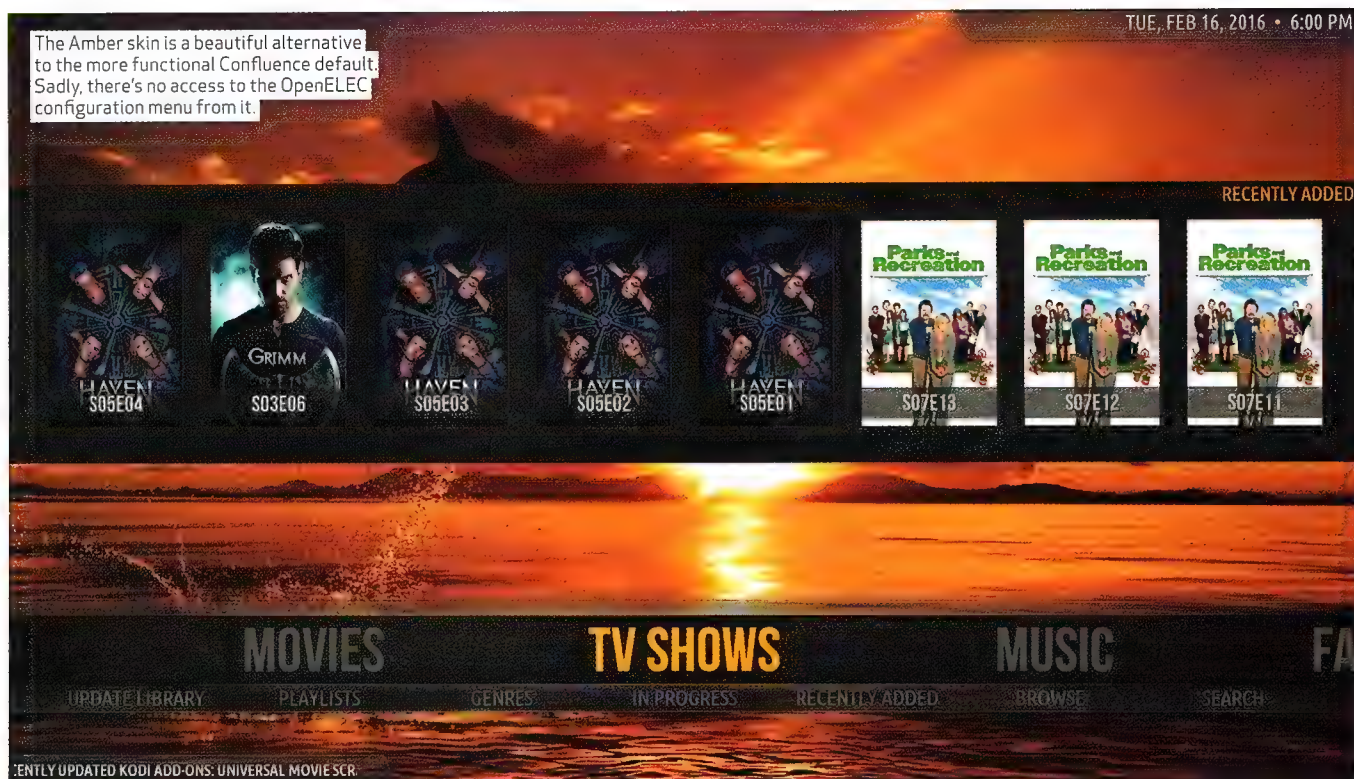
You'll want to use `sudo dd if=openELEC-RPi2.arm-b.0.1.img of=/dev/sdc bs=4M` if installing OpenELEC on the Raspberry Pi 2. Wait while the image is written to your micro SD card — this may take a while,

and there's no progress bar, so be patient (time for a cup of tea, perhaps?).

Once complete, unmount your drive and then eject it. Insert the micro SD card into the Pi, connect it up to monitor and keyboard and switch it on. You should immediately see a green light flash, and the screen come on.

The OpenELEC splash screen will appear, at which point, it'll tell you it's resizing the card — it's basically creating a data partition on which you





"You'll also see tabs for movies, TV shows and music — once you've populated your media libraries, you'll be able to browse and set up content to play from here."

can store media locally if you wish. After a second reboot, you'll eventually find yourself presented with an initial setup wizard for Kodi itself.

If you've not got a mouse plugged in, use Tab or the cursor keys to navigate between options, and Enter to select them. Start by reviewing the hostname — OpenELEC — and changing it if you're going to run a media server and the name isn't obvious enough already. Next, connect to your Wi-Fi network by selecting it from the list and entering your passphrase. You can then add support for remote SSH access, as well as Samba (see SSH Access box, above).

You can now control Kodi remotely if you wish via your web browser: type '192.168.x.y:80' into your browser (substituting '192.168.x.y' with your Pi's IP address). Switch to the Remote tab and you'll find a handy point-and-click on-screen remote to use — what isn't so obvious is that your keyboard now controls Kodi, too, as if it were plugged into your Pi directly. You'll also see tabs for movies, TV Shows and music — once you've populated your media libraries, you'll be able to browse and set up content to play from here.

This approach relies on your PC or laptop being in line of sight of your TV.

If that's not practical, press your tablet or phone into service as a remote control instead. Search the Google Play store for Kore (Android) or the App Store for Kodi Remote (iOS) and you'll find both apps will easily find your Pi and let you control it via a remote-like interface.

By default, OpenELEC uses DHCP to connect to your local network. If your Pi's local IP address changes, it can be hard to track it down in your web browser for remote configuration. Change this by choosing 'System > OpenELEC > Connections', selecting your connection and hitting Enter. Choose 'Edit' from the list and pick 'IPv4' to assign a static IP address you'll be able to use to always access Kodi in future. You can simply stick with the currently assigned address, or pick another. Make sure you select 'Save' to enable the change. If all of this sounds like too much bother, check out the box on SSH (SSH access back over the page) for a way to change the underlying configuration files instead.

SET UP LIBRARIES

The first thing to do is add your media to your library. Kodi supports a wide range of containers and formats, so you

should have no problem unless you've gone for a particularly obscure format. Check the box Add content to your library, opposite, for advice on naming and organising your media so that allows Kodi to recognise it and display extra information about TV shows and movies. This uses the help of special 'scrapers': tools that extract metadata from online databases such as movie titles, TV episode synopses and artwork to pair them with your media files for identification.

Where should you store this local content for Kodi to get at it? If your micro SD card is large enough — we'd suggest 64GB or greater — then you can store a fair amount of video and music on there. You can transfer files across the local network — open File Manager and opt to browse your network. Your OpenELEC device should show up — double-click the file-sharing entry and you'll see folders for Music, Pictures, TV Shows and Videos. Simply copy your files here to add them to your library. Once done, browse to Video or Music and the media files should already be present and accounted for, although at this point in time, they've not been assigned a scraper to help you identify them yet.

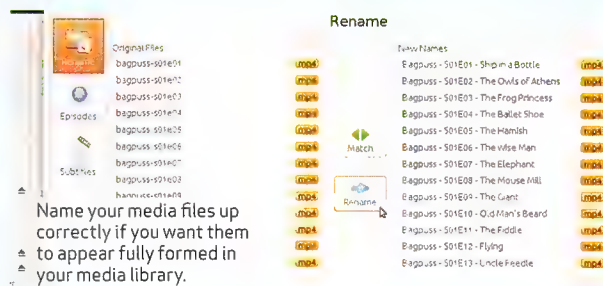
It can be slow copying files across in the network — you can transfer files directly to the card when it's mounted in a card reader on your PC, but you'll need to access File Manager as root to do so — in Ubuntu, for example, typing `# gksudo nautilus` and hitting Enter will give you the access you need. A simpler option — if you have a spare

Add content to your library

Kodi works best with your locally stored digital media, but for it to recognise your TV shows from your music collection, you need to name your media correctly and organise them into the right folders, too.

Kodi supports the same naming convention as its rival services Emby (see APC 428, page 53 for more details) and Plex — use the following table to help you.

Need to rename files in a hurry? Then Filebot (www.filebot.net) is your new best friend — we discussed it along with Plex and Kodi in more detail last month; see APC 428 page 54.



TYPE	FOLDER STRUCTURE	SYNTAX	EXAMPLE
MUSIC	MUSIC\ARTIST\ALBUM	ARTIST - TRACK NAME	MUSIC\DAVID BOWIE\BLACKSTAR\DAVID BOWIE - LAZARUS.MP3
MOVIES	MOVIES\GENRE\MOVIE TITLE	TITLE (YEAR)	MOVIES\SCI-FI\STAR TREK\STAR TREK (2009).MKV
TV SHOWS	TV\GENRE\SHOW TITLE\SEASON	TVSHOW - S01E01	TV\SCI-FI\FRINGE\SEASON 5\FRINGE - S05E09.MKV
MUSIC VIDEOS	MUSIC VIDEOS\ARTIST	ARTIST - TRACK NAME	MUSIC VIDEOS\A-HA\A-HA - VELVET.MKV

USB port on your Pi — is to store your media on an external thumb or hard drive. Just plug the drive into your Pi, browse to Videos or Music and choose the 'Add...' option. Click 'Browse' and select the top-level folder containing the type of media you're adding — TV, movies or music. If you've plugged in a USB device, you'll find it under 'root/media', while NAS drives are typically found under 'Windows Network (SMB)'. Once selected, click 'OK'.

The Set Content dialogue box will pop up — use the up and down arrow buttons to select the type of media you're cataloguing and verify that the selected scraper is the one you want to use. Check the content scanning options — the defaults should be fine for most people — and click 'Settings' to review advanced options (you may want to switch certification country to Australia for movies, for example). Click 'OK' twice and choose 'Yes' when prompted to update the library.

Once done, you'll find a new entry — Library — has been added to the media menu on the main screen. This gives you access to your content with filters such as genres, title or year to help navigate larger collections. Now repeat for the other types of media you have. If you want to include multiple folder locations within single libraries, you'll need to browse to the Files view, then right-click the library name (or select it and press 'C' on the keyboard) to bring up a context menu. Select 'Edit Source' to add more locations, and 'Change Content' to change the media type and scraper if necessary.

The smartest thing to do with any digital media library is host it on a media server, which allows you to easily access it from other devices on your network and, in some cases, over the wider Internet. Kodi has UPnP media server capabilities that work brilliantly with other instances of Kodi on your network, as well as making your media accessible from other compatible clients. Media servers can be quite demanding, so we don't recommend using a Pi Zero or Pi Model B+. Instead, set it up on your most powerful PC (or Pi 2) and use OpenELEC to connect to it as a client.

As media servers go, Kodi's is rather basic. If you want an attractive, flexible server, then you might want to consider Emby (see APC 428, page 53). Pair this with the Emby for Kodi add-on and you can access your Emby-hosted media without having to add it to your Kodi library. A similar add-on exists for users of Plex Media Server too, PlexBMC (bit.ly/PlexBMC), providing you with an attractive front-end.

If you want access to other UPnP servers via Kodi without any bells and whistles, then browse to 'System > Settings > Services > UPnP/DLNA' and select 'Allow remote control via UPnP'. You can also set up Kodi as a media server from here: select 'Share my libraries' and it should be visible to any UPnP client on your network, although you may have to reboot.

Performance is obviously going to be an issue on lower-powered devices, such as the Pi, and while the Pi 2 is pretty responsive out of the box, you may find the Pi Zero struggles at times. It pays, therefore,

to try to optimise your settings to give your Pi as many resources as it needs to run smoothly.

Start by disabling unneeded services — look under both 'System > OpenELEC > Services' (Samba isn't needed if you're not sharing files to and from Kodi, for example) and 'System > Settings > Services' (AirPlay isn't usually required). Incidentally, while you're in 'System > Settings', click 'Settings level: Standard' to select first 'Advanced > Expert' to reveal more settings.

One bottleneck for Pi devices is dealing with large libraries — give it a helping hand by first going to 'Settings > Music > File lists' and disabling tag reading. Also go into 'Settings > Video > Library' and disable 'Download actor thumbnails'. You can also disable 'Extract thumbnails and video information' under File Lists, but you'll lose a lot of eye candy and the thumbnail caching for future use.

The default Confluence skin is pretty nippy, although if you suffer from stutter when browsing the home screen, consider disabling the showing of recently added videos and albums: select 'Settings > Appearance', then click 'Settings' in the right-hand pane under Skin. Switch to 'Home Window Options' and deselect both 'Show recently added...' options.

Speaking of Confluence, if you don't like the default skin, then try Amber — it's beautiful to look at, but easy on system resources. You do lose access to the OpenELEC settings when it's running, but you can always switch back to Confluence temporarily or use SSH for tweaks, if necessary. ■

Ten ways to rebirth your old Android device

Don't let that old tablet or phone prop up your coffee table. There's plenty your old Android tech can do. Darren Yates explains.

According to research analyst firm Deloitte, one billion smartphones were purchased in 2015 – as upgrades (tinyurl.com/zbgc4yv, PDF). Think about it for a sec – that's not first-time buyers; that's people buying replacement phones. That means one billion smartphones being cast aside, one billion smartphones languishing in kitchen drawers, holding up shelves and left in the back of taxis. Enough, we say! Too many smartphones are retired long before their use-by date and there's still plenty they can be doing around your home. Here's ten ways your old Android device can earn its keep.

GAIN ROOT ACCESS

If this device is no longer your front-line choice, have some fun with it and learn more about Android by gaining root access. Root access can allow you to update your version of Android OS (where available), take full control of the device and perform new functions like turning it into a wireless file server.

Most Android devices can be 'rooted'; those that can't typically have what's known as a 'locked bootloader' that stops it loading custom recovery ROMs

such as ClockworkMod Recovery (CWMR) and TeamWin Recovery Project (TWRP).

There are usually multiple ways to root most devices, but one-step root applications like Kingo ROOT (www.kingoapp.com) are most popular. However, you must be aware that there's a remote possibility rooting your Android device may 'brick' it, causing it to fail permanently. Our tip is make sure any rooting app of choice has a history of success with your device make and model before trying it – that way, you're more likely to win.

If your device is out of warranty, there's probably not much point telling you that rooting your device voids those warranties (it does, nevertheless).

FLASH A NEW OS

One reason to gain root access is to update the version of Android OS your device is running. My Galaxy S3 phone is a perfect example – it arrived with Android 4.0.4 (Ice Cream Sandwich) and despite Samsung losing interest in it after releasing an Android 4.3/Jelly Bean update, it now happily runs the custom 'Resurrection Remix' release of Android 6.0.1/Marshmallow.



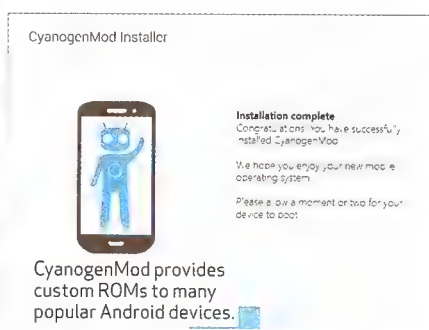
Flir's new ONE thermal imaging module works with Galaxy S5 smartphones.

It must be said, few devices will find that level of upgrade possible, but it's worth checking out websites like XDA Developers (www.xda-developers.com) and community ROM projects such as CyanogenMod to see if there's a newer OS release for your device. You might be lucky and find a factory OS update you've forgotten to install.

The key, however, is making sure any update is for your specific device, down to the exact model number. Each Android device has a different combination of hardware and your upgrade ROM must have all the correct drivers for each component in your device for those components to work. Clearly, install the wrong ROM and you're an odds-on favourite of bricking your device, so researching what's available carefully beforehand is vital. Again, if you're worried about warranties, probably best to give this a miss.

NETFLIX/CHROMECAST REMOTE

Netflix has revolutionised the way we watch television and Google's Chromecast has brought TV smarts to any display device with a spare HDMI port. Now provided your Android device has at least Android 4.0.3 and working Wi-Fi, it could be a great option for use as a Netflix/Chromecast remote.





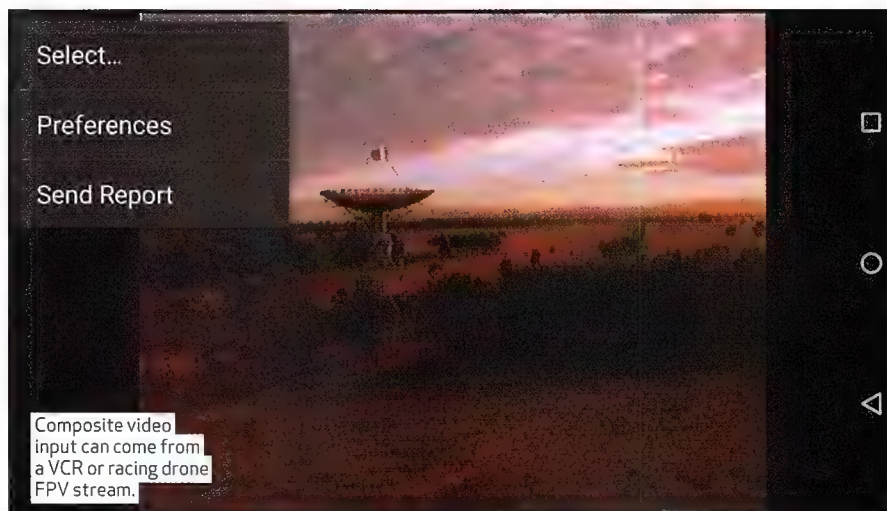
EasyCap USB video dongle turns Android devices into a composite monitor.

The Chromecast dongle has its own CPU and internal hardware, but allows you to use your Android phone as a Wi-Fi remote for selecting movies or videos to play. If your device has at least Android 4.2/Jelly Bean and supports the functionality, chances are good you can even throw or 'cast' your device screen to the Chromecast dongle and display it on your TV. The delay or 'latency' may be too much for effective big-screen gameplay on the original Chromecast, but for viewing photos or general apps, it can work well. The new Chromecast 2 device sells for around \$59 at most major retailers and the Google Cast app is free on Google Play.

USB MICROSCOPE

Any device launched with Android 4.0 as standard should have a USB-OTG port, the dual-direction microUSB connection. Now you probably know you can grab a USB-OTG adapter cable and plug in a wide array of storage devices into your device. But you can also try a low-cost USB microscope, some of which sell online for under \$20.

At this price, you typically get a 30fps VGA (640 x 480-pixel) camera



with up to 500x magnifier, enough to zoom in on the subpixel structure of your smartphone display panel (a task we've used this technique for on numerous occasions).

But for it to work, your Android device needs to have Universal Video Camera (UVC) drivers built into the Android kernel, something we've found in most devices we've tested. But you also need the right USB cam software – we recommend trying CameraFi, DashCam by droidPerception and UsbWebCamera, all free on Google Play. Strangely, we found different combinations of microscope and Android device required a different camera app to work correctly. But the end results were impressive, particularly for a \$20 spend.

WIRELESS FILE SERVER

Take a look under the bonnet of a typical network-attached storage (NAS) box and you'll find a CPU similar to what's inside many smartphones and

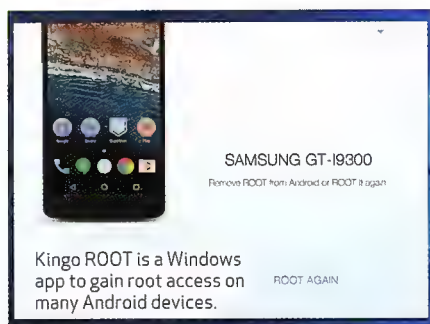
tablets – a dual- or quad-core ARM Cortex A-series SoC. While any NAS box will beat a smartphone for installed storage, your smartphone or tablet counters by including Wi-Fi, possibly up to 802.11n grade, and many support microSD expandable storage up to at least 32GB.

If you can gain root access, install the apps SambaDroid and Paragon NTFS from Google Play and you'll turn your phone into a very compact wireless file server, fast enough to stream video files. Sure, 32GB of storage isn't much, but throw in an externally powered USB hard drive, connect it up via USB-OTG to your Android device and you can have a multi-terabyte wireless file server ready to roll.

The only drawback is that using USB-OTG as a USB Host port prevents external power charging up the Android device battery, so this works best with Android tablets having a separate, dedicated DC power input,



The new Google Chromecast 2 replaces the original model.



Resurrection version
ResurrectionRemix-M-v5.6.0-20151215-i9300

About Resurrection
Everything about the Rom

Status
Phone number, signal, etc.

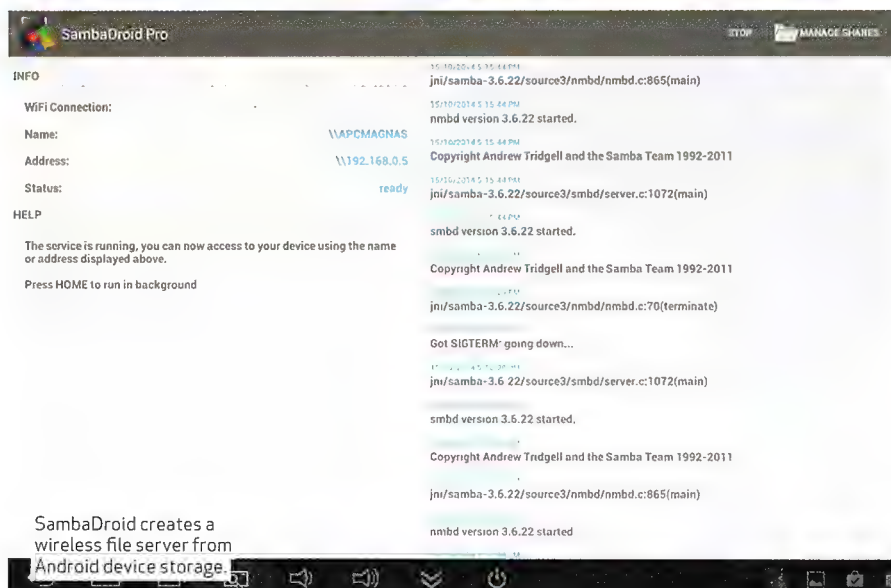
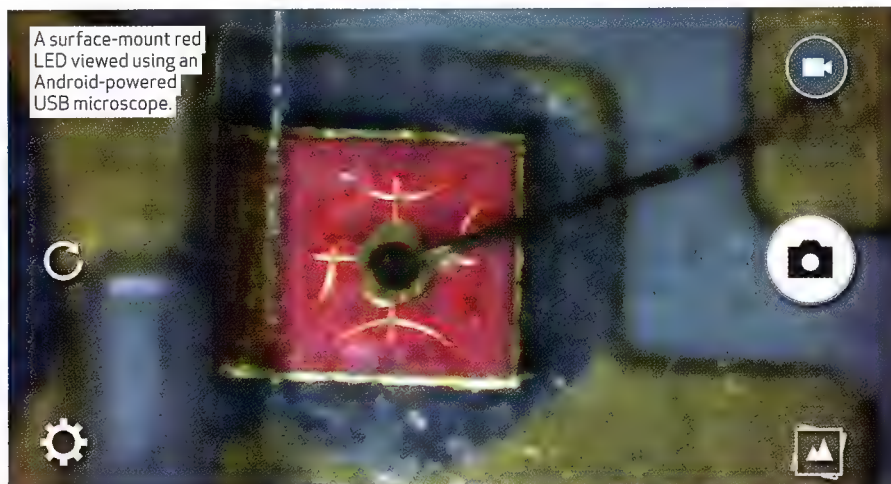
Legal information

Model name
GT-I9300

Android version
6.0.1

Android security patch level
1 December 2015

Samsung's Galaxy S3 running the latest Android 6.0.1/ Marshmallow OS.



aside from USB-OTG. SambaDroid also works best with Android 4.4 devices and older.

CD-QUALITY AUDIO RECORDER

The market for portable digital audio recorders has exploded in recent years, with dozens of models from brands like Tascam, Zoom and Marantz. Not surprising really, because many smartphones we've tried are terrible at recording audio. Sure, all Android devices can capture audio through the built-in microphone or 3.5mm headset socket, but add in a quality USB sound module, along with the excellent USB Audio Recorder PRO app from Google Play and you can capture genuine CD-quality stereo sound to at least 48kHz/16-bit sample rates.

Google added USB Audio Class drivers as standard, beginning with Android 5.0/Lollipop, but the team behind USB Audio Recorder PRO baked their own UAC code into the app, enabling use on Android devices back to Android 4.0. There's a compatibility page listing the USB audio devices known to work with the app (tinyurl.com/ngdz3og), but the key feature here is that audio quality no longer depends on your Android device – it just captures the digital data stream from the USB audio device. That means you can capture high-quality audio from USB microphones, cassette players, guitar audio modules, even turn your LPs into digital audio straight to many Android devices. Again, mileage can vary depending on the Android device.

THERMAL IMAGING CAMERA
I don't mind Caterpillar's new S60 thermal imaging smartphone, a ruggedised design made in conjunction with thermal imaging brand Flir. But it's not the only way to get thermal imaging onto your smartphone. Flir also created the Flir ONE, a thermal imaging module designed for iOS and Android devices.

It combines a thermal imaging sensor into a microUSB module that sits on the end of your phone and, for under US\$250, it's the cheapest way to get hold of a thermal imaging camera. Unfortunately, it seems to need a

decent level of horsepower also – Flir has successfully tested the ONE with Samsung's Galaxy S5 and S6 phones, the Motorola Nexus 6 and HTC's ONE M8. But the ASUS Nexus 7, Samsung's Galaxy Tab S 8.4 and 10.5 all produced slow video recording.

Flir is now shipping the ONE to Australia, although we are yet to test one. However, it seems to stretch the capabilities of all but the more recent of Android devices.

A cheaper but still useful add-on for older devices is one of the many low-cost inspection cameras that give you a VGA-resolution standard colour image sensor and built-in LEDs on the end of a long cable. These work on a minimum of Android 4.0 like USB microscopes – via USB-OTG adapter and the collection of apps we mentioned before. It's possible that not every model will work on every Android device, but with two-metre cable inspection cameras starting from US\$5 on eBay, it won't break the bank to find out.



TURN IT INTO A PC

Yep, this is actually doable and it doesn't need root access. All you need is an Android 4.2/Jelly Bean device with screencast support, built-in Bluetooth and Wi-Fi, a Chromecast dongle and Bluetooth wireless keyboard and mouse. What's cool about this is the only physical connection you need to your phone is the microUSB cable to the AC power adapter.

Use your phone's screen casting function to cast the screen to your Chromecast dongle and TV/monitor, then pair your keyboard and mouse to your Android device's Bluetooth adapter. You now have an Android-powered computer. I've done this with my Galaxy S3 phone and was even able to keep the Wi-Fi Internet connection working at the same time.

Is it practical? That depends on how you work — if you live in the cloud and use Google Docs, it could be a way to shrink down your PC.

It certainly would be a quick and easy way to take your computer with you — just grab your phone and you're gone.

COMPOSITE VIDEO MONITOR

Turning a smartphone or tablet into a video screen? It's an option we've heard some use for first-person view (FPV) video from racing 'drone' cameras. Many unmanned aerial vehicles (UAVs) used in racing feature low-power video camera transmitters for real-time FPV vision. That video is captured via receiver module, fed into a USB video capture device, which can be displayed on an Android screen. The trick is having: a) USB Video Class (UVC) drivers on your Android device; and b) the right video chip in your 'EasyCap' branded USB video capture dongle.

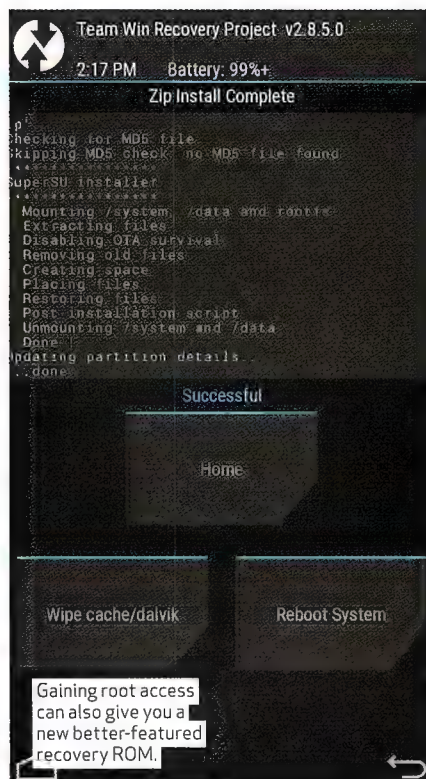
EasyCap is a generic brand of dongle featuring one of three video processing chips — the STK1160, the UTV007 and the HTV600. The latest dongles we've seen use the HTV600, which works with the EasyCap Viewer app on Google Play. But there is

another trick — in our testing, we needed video going into the dongle before launching the app, otherwise the app would crash. Once we figured this out, we had smooth 25fps PAL composite video displayed from an old VCR. These dongles are everywhere on eBay and sell for as little as \$7.

We can't guarantee it'll work with every Android device, but it worked with the devices we tested

(Acer Aspire A200, Samsung Galaxy S3). There's no audio support, though.

USB microscopes like this sell on eBay for under \$20.



SELL IT

Recent data from eBay says Australia has \$6.4billion worth of unused smartphones lying around in kitchen drawers (tinyurl.com/j27kdq6). While the online selling site no doubt has incentive for getting us to unload our smartphones, selling a smartphone requires preparation. For one thing, you need to make sure you're not giving away more than just the phone itself.

We're assuming you'll know to back up your contacts, important files, call logs and anything else you want to keep. The most important thing now is making sure your device has no important information left on it someone could use against you — like bank account details and so on.

Today, it's recommended that the first thing to do if your phone has the option is to encrypt the on-board data — you'll likely find this under Settings, Security, Encrypt phone. This will make it difficult for anyone to snoop into your history. Once completed, do a factory reset — you'll find this under 'Settings > Backup & Reset > Factory data reset'.

Also, don't forget to remove the SIM card and any removable storage. You should also disable device access to your Google account and uncouple any cloud services you've used with it. Think of it as 'consciously uncoupling' your life from your phone — although, it is time-consuming and possibly reason why \$6.4billion worth of phones lie around in kitchen drawers. ■

Play 48kHz stereo WAV files with nanoPlayer 2

Our new Arduino Nano-powered WAV player now supports 32, 44.1 and 48kHz/8-bit stereo files. Darren Yates explains how he did it.

Last month, we introduced nanoPlayer, a small Arduino Nano-powered audio player that plays 8-bit mono WAV files to 19kHz sample rate using just a microSD card reader, some passive electronic components and the popular TMRpcm library.

Since then, we've ditched the TMRpcm library and written our own code from scratch. Now, nanoPlayer 2 handles 8-bit stereo WAV files at 32, 44.1 and 48kHz. Here's how.

COUNTERS/TIMERS

The Arduino Nano is powered by a tiny chip called the Atmel ATMEGA328P. Inside are three key functions called 'timers'. More accurately, they're counters that increment one count per clock cycle (the Nano has a 16MHz clock speed). Timer0 is an 8-bit (256-count) timer that controls Arduino's millis() and delay() code functions. Timer1 is a 16-bit (65536-count) timer and Timer2 is another 8-bit timer – both are general purpose and free to use. You can use Timer0 also but doing so may muck up the millis() and delay() functions.

However, each timer is also capable of creating PWM (pulse-width modulation) output and this is the key to turning WAV file digital data into an analog voltage.

AUDIO SAMPLE TIMING

For the audio files to play at the correct speed, we must play the samples at the required rate. The WAV file header

The Arduino nano is a compact version of the Arduino Uno.

provides all that information – we've got no space here but read my previous story on our website (tinyurl.com/zr5d9zr).

The ATMEGA Timers have two important variables or 'registers' – OCRxA and OCRxB – where 'x' is replaced by the timer number, for example, OCR1A/OCR1B for Timer1.

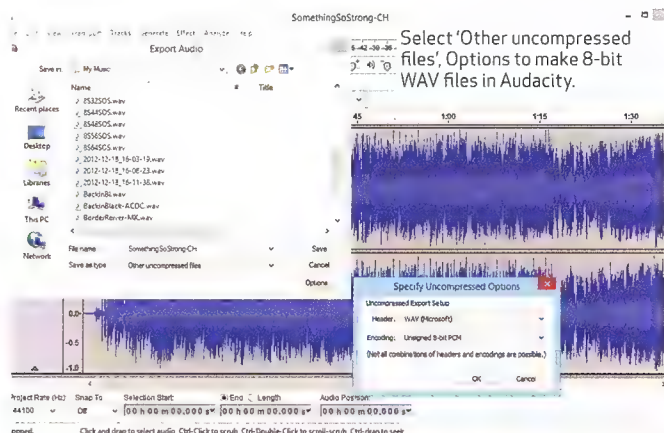
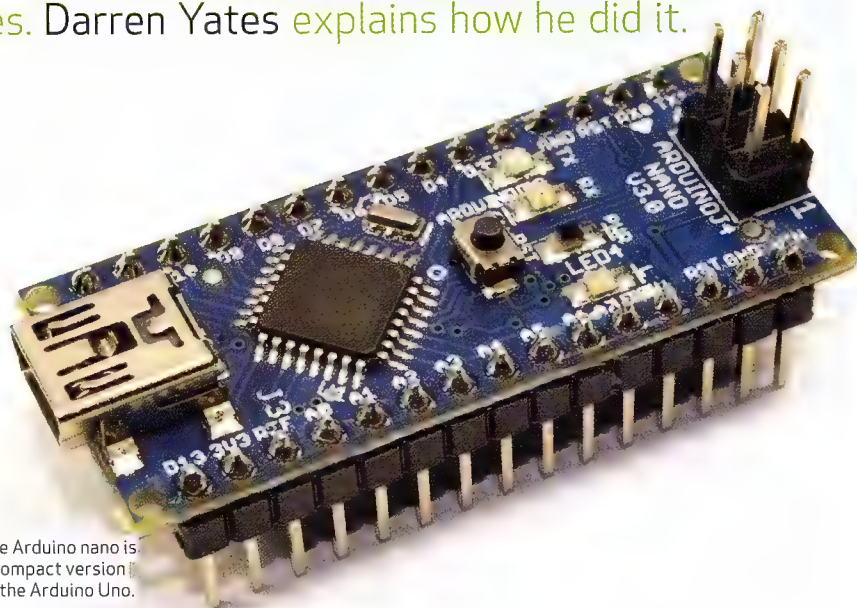
Timer1 has an output, OC1B, which produces the PWM signal that, when filtered, will be our audio signal. If the OC1B output isn't time-controlled precisely, the audio will be at the wrong pitch.

As the timer begins its count run, the OC1B output immediately switches high. As the timer counts up, it eventually reaches the audio sample number we've previously loaded in to

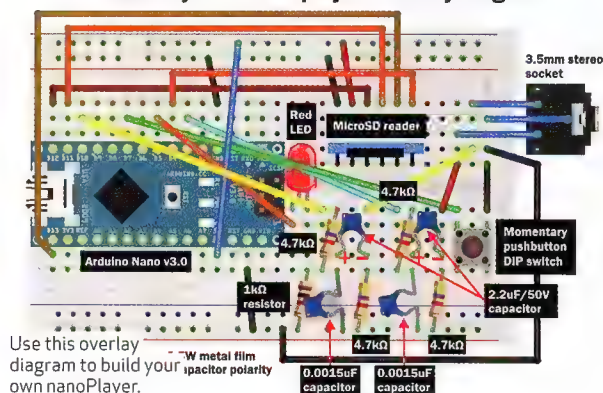
register OCR1B – this forces OC1B output to drop low. The timer continues counting, but when it hits the number in OCR1A, it does two things – it resets the timer count back to zero, but also triggers the timer interrupt.

HARDWARE INTERRUPTS

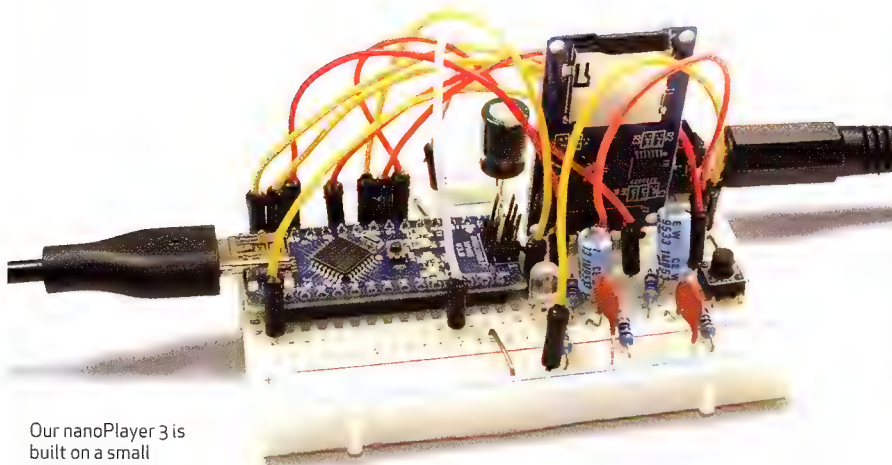
When you interrupt a conversation, you interrupt (politely), say your piece, leave and the original members of the conversation continue as before. A code interrupt does the same thing – it allows us to bookmark the current code position to run another function and, when completed, go back to the bookmark point and carry on. The code we launch at the interrupt is called an Interrupt Service Routine (ISR). By attaching this to a timer, we can have



nanoPlayer 2 audio player - overlay diagram



Use this overlay diagram to build your own nanoPlayer.



Our nanoPlayer 3 is built on a small 400-point breadboard.

this code run at precise intervals – those intervals can be set by the number we load into OCR1A.

Let's say we set OCR1A to decimal '250'. Setting the Timer to count using what's called 'Phase-Corrected PWM' technique, we start with 16MHz (the ATMEGA clock speed) and divide it by two. We now divide the resultant 8MHz by 250 and we get 32,000 – that means the timer will hit the OCR1A point and launch our ISR 32,000 times per second or 32kHz. This also happens to be one of the common sample rates for WAV audio files.

Change OCR1A to decimal '181' and do it again. Divide 8MHz by 181 and you get 44,198, which is as close as we can get to 44,100Hz or 44.1kHz, the CD audio sample rate.

RING BUFFERS AND CARD STORAGE

But what are we actually doing 44,198 times a second? The ISR code grabs the next audio sample from the ring buffer and loads it into OCR1B. The ring buffer is two 256-byte blocks of RAM – while data is regularly picked out from one block by the ISR, the rest of our code keeps count of the bytes played and continues to load up data from the microSD card into the other block. The ISR alternates between each ring buffer block.

How does this create the audio output? Say the audio sample value is low compared to the OCR1A value, say '10' – Timer1 takes little time to reach that OCR1B number, resulting in short positive-going pulses, or a short 'pulse-width'. When filtered, this produces a low analog voltage. If the sample is high, say '170', Timer1 takes much longer to reach the OCR1B count, resulting in a long pulse-width, which becomes a higher analog voltage. Do this fast enough and you get an audio signal. This whole process continues until we run out of samples (reach the end of the file) and nanoPlayer starts playing the next file.

To get stereo, Timer1 handles the ISR and the left-channel audio, Timer2 the

right channel, but no ISR (Timer1's ISR handles both channels).

HOW IT WORKS

Our new nanoPlayer 2 has play, pause and next track functions using just one momentary push-button switch. Press the button to start playback of the first file, press again to pause, press again to un-pause. Hold down the button to skip to the next track.

All files must be 32, 44.1 or 48kHz sample rate with 8-bit stereo samples. The source code automatically skips files that don't match these requirements and all files must be in the root folder of a FAT32-formatted microSD card up to 32GB capacity. Files

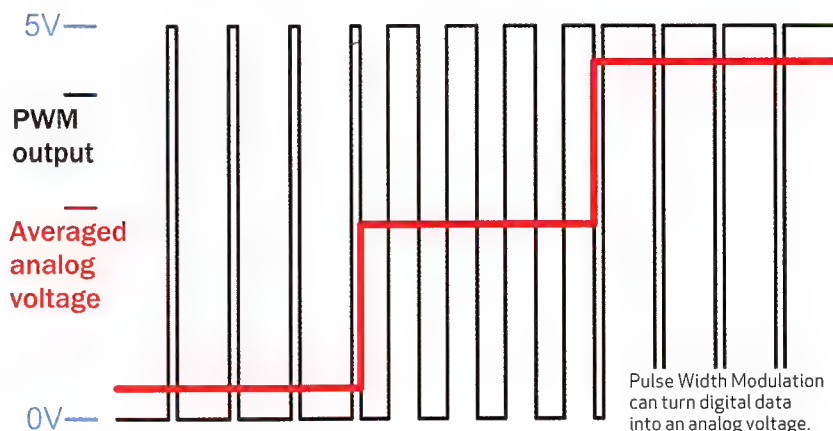
can be 4GB in size and you can create 8-bit WAV files using Audacity (www.audacityteam.org).

HOW TO BUILD IT

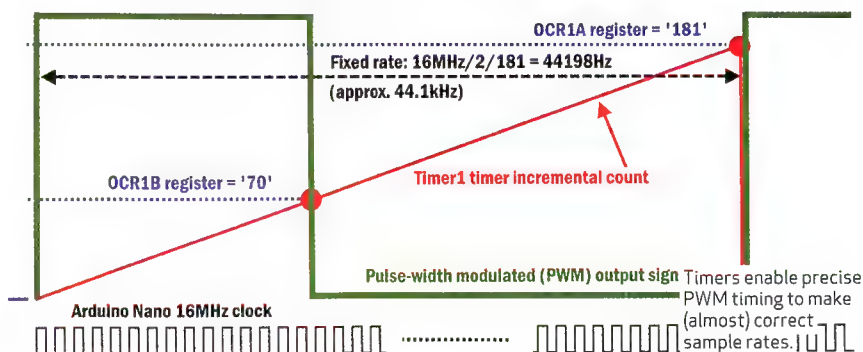
Get a 400-point breadboard, an Arduino Nano, a microSD card module and the other components shown on the overlay diagram (try eBay). Some soldering will be required, wires to the 3.5mm stereo socket and possibly the header pins on the Arduino Nano. Can't solder? Get a knowledgeable mate to help or learn via one of the many online tutorials – it's time you learned anyway. Practise before soldering the Arduino Nano.

CODING THE ARDUINO NANO

Download the Arduino IDE v1.6.5 (not the latest version) from arduino.cc/download, grab the source code from our website at apcmag.com/magstuff. Unzip the source code file, copy the contents of the libraries subfolder to the same of your Arduino IDE install and restart the IDE. Load up the source code, plug in the Arduino Nano and flash the source code. Plug a 3.5mm stereo cable from the socket to your computer speakers. Now plug in the microSD card, plug in USB power into the Arduino, wait for the 'card ready' twin LED flashes, press the button and set the volume to suit. ■



How Timers can create custom PWM waveforms



Code your own chat network

Darren Yates combines Java threads and networking to create a chat client and server that combines to build your own home chat network.

Facebook Messenger, Google Chat, Twitter – real-time chat systems are among the most popular apps ever developed. They're not just cool for chatting to another person, they're great for chatting with a whole group of people. So this month, we're combining almost everything we've learned about Java programming over the last year to create a complete private chat network, consisting of separate client and server apps.

GET THE SOURCE CODE

You'll find the source code for this month's project on our website at apcmag.com/magstuff. You'll also find two .jar (Java Archive) files – HomeChatServer.jar and HomeChatClient.jar. These are run-time files – you just need the Java Runtime Environment (JRE) pre-installed on each machine, double-click on the appropriate JAR file and you're away. You can download the latest JRE from Oracle's website at tinyurl.com/apc429-jre. To edit the source code, grab the NetBeans IDE and Java SE Software Development Kit Bundle from Oracle at tinyurl.com/apc429-bundle.

Unzip the outer source code zip file, launch NetBeans, select 'File > Import Project > From ZIP' and choose either of the inner project zip files.

HOW IT WORKS

Our 'Home Chat Network' is designed to work on a local-area network (LAN), such as that found in most homes, with multiple PCs connected up, either using

wired or wireless tech, to a single ADSL or cable modem connected to the Internet.

The chat system itself consists of two parts – a server app that acts as the central distribution box for all chat messages; plus the client app, which runs on each PC connected to the LAN. Any client can send a message to the chat network and that message is distributed to every other client on the chat network via the server. Think of the server app as the hub of a bicycle wheel with clients at the outer rim.

It sounds straightforward, but under the bonnet, we're taking the Java networking we started with last month and combining it with Java threads to enable multiple Java apps to communicate with each other in real time. That makes things a little more complicated.

SETTING UP THE PCS

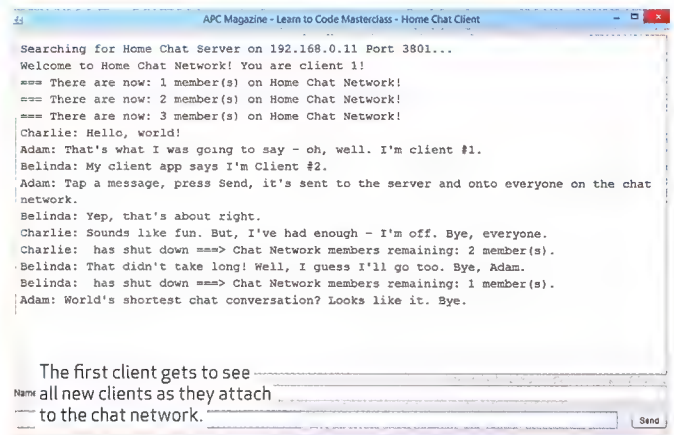
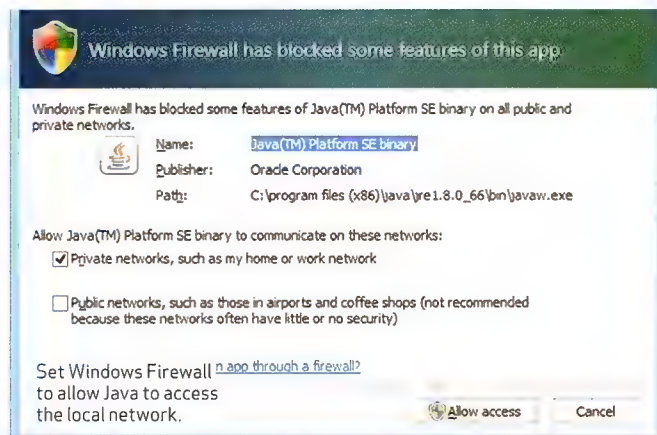
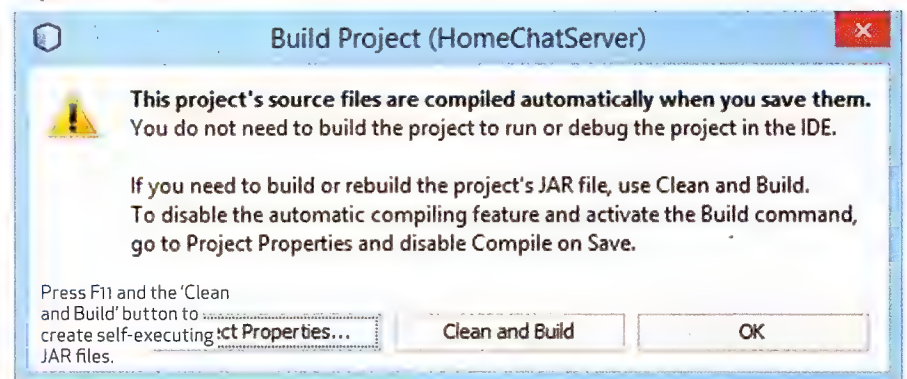
This is the straightforward bit. To run the chat system, first launch the Home

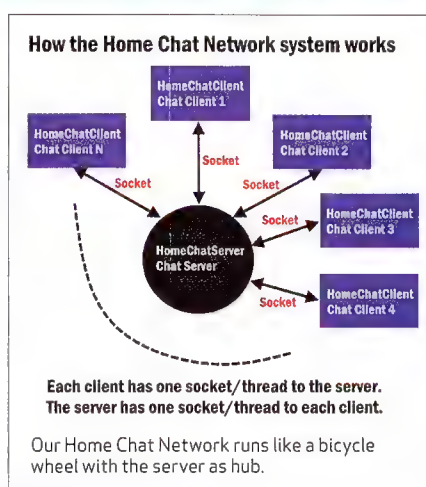
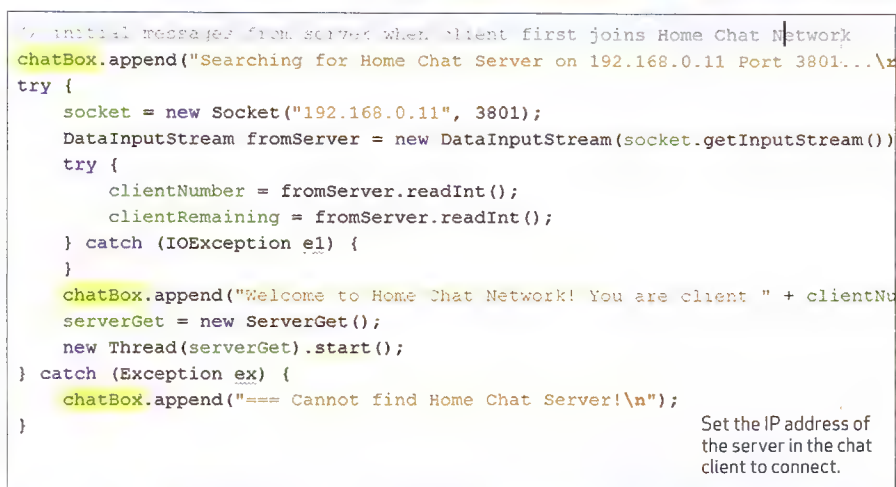
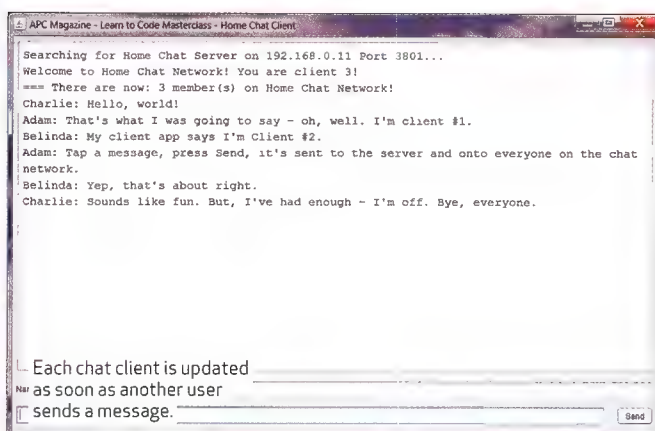
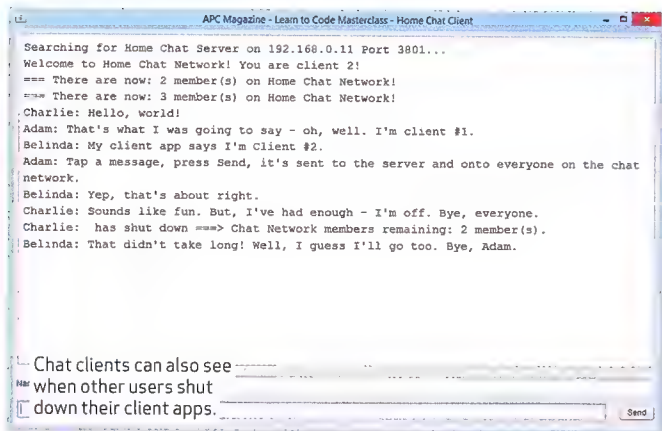
Chat Server app (HomeChatServer.jar) on the PC you want to be the server. Next, launch HomeChatClient.jar, the client app, on each of the client systems you want sending and receiving messages (this can include the server PC itself). Provided they're hooked into your home network, the whole thing should now be ready to go.

CHAT SERVER CODE

We'll start with the chat server app. The GUI (graphical user interface) here is nothing more than a JTextArea sitting inside a JScrollPane. It logs all activity from the clients as they connect and disconnect, along with the messages they send. The tricky stuff is in how the server actually does its work.

Look at the 'HomeChatServer()' constructor and the first few lines set up the interface and title text. After that, we get to the 'try{}' statement; it's the code here that drives what goes on.





"A client can send a message at any time — the server has no idea when, but it needs to be ready and waiting for when it does."

It starts with appending some basic welcome text to the serverStatus JTextArea, followed by creating the server socket with the port number '3801'.

Next comes a seemingly-odd line — 'while(true)'. The 'while()' function works by continuing to loop through the statements inside the loop until the Boolean-conditional statement inside the brackets evaluates to 'false'. But since 'true' is always true, we're just saying 'loop this code forever'.

That code begins with the server waiting for a client to request a connection via the 'serverSocket'. accept()' statement. Remember, Java waits at this statement until a client pings in. Once a client app does so, the new socket connection created is assigned to a Socket object called 'chatSocket', which then gets added to an ArrayList of chat sockets called (appropriately) 'chatSockets'.

Put another way, we're creating a great big telephone book of clients and, each time a new client connects, its socket connection 'phone number' is stored in our phonebook.

So now we've established a socket connection with the client, we next create a new DataOutputStream object that allows us to send messages direct to that client.

After that, we send some basic data to the client — first, we increment the static 'clientNo' integer variable and send that, then we send the size of the chatClients ArrayList. Why? The 'clientNo' variable tells each client which number it is in the list and the size of the ArrayList tells the user how many clients are currently connected. Next, the following three 'append' statements document the new client's arrival to the server's serverStatus text area, including hostname and IP address.

THREADS GALORE

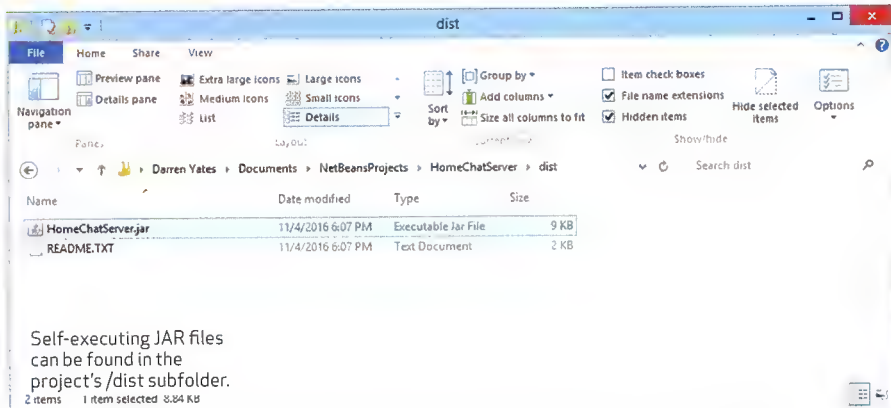
The following code line is key:

```
new Thread(new
ClientProcessFrom
(chatSocket)).start();
```

This launches a new anonymous thread of the ClientProcessFrom class. Every new client ping to the server causes a new thread to be created. This is really important — think about how a chat network works for a sec. A client can send a message at any time — the server has no idea when, but it needs to be ready and waiting for when it does. You can't have a chat server that misses messages, so the server has to be ready for the possibility that any client could send a message at any time.

The only way you can do that sanely is to launch a separate thread that listens exclusively to each client. The chat network has ten clients on the go? The server runs ten extra threads to listen out for each one.

But what happens if a client shuts down? There's little point wasting resources, so each thread listens out for a special 'close' command. The client only sends text messages to the server, so when the user shuts down their client app, the last thing the client does is send a



Self-executing JAR files can be found in the project's /dist subfolder.

```
// method to broadcast chat to each client (via arraylist of chat sockets)
void sendChat(String name, String message) throws IOException {
    for (int dloop = 0; dloop < chatSockets.size(); dloop++) {
        PrintWriter out = new PrintWriter(chatSockets.get(dloop).getOutputStream());
        out.println(name+": "+message);
    }
}
```

```
// method to remove a closed client from the arraylist
void removeClientFromList (Socket socket) {
    for (int dloop = 0; dloop < chatSockets.size(); dloop++) {
        if (socket == chatSockets.get(dloop)) {
            chatSockets.remove(dloop);
        }
    }
}
```

The sendChat and removeClient methods both use for-loops.

As for code, the client app needs to launch a separate thread here as well, for much the same reason as we need to on the server. Again, any client can send a message any time – and if each client is to receive that message from the server, the client needs to have ears out for the server, ready to receive it at any time.

We could choose to just use the main GUI thread for this, but as we've seen previously, the GUI would appear frozen until a message came through, which means no client could actually send a message, making the whole thing useless!

Head to the HomeChatClient() constructor, scroll down until you reach the 'try()' statement. Again, this is where the action begins.

First up, the client assumes the chat server is up and running and waiting to hear from a client, so the first thing we do is request a socket connection with the server. Now to keep this simple, we haven't implemented DHCP (dynamic host configuration protocol), so you must type the server's IP and port address manually into this line:

```
socket = new
Socket("192.168.0.11", 3801);
```

These are listed in the server app's 'serverStatus textarea' on first launch. As soon as the connection is made, the server is ready to send a welcome message, so next, we get the client to rig up a DataInputStream to read that incoming message. After that, we create a new instance of the 'ServerGet' class and launch it as a new thread.

CLIENT THREAD

If you've been with us from the start of this Java Masterclass series, you'll hopefully remember using the 'Scanner' class to read input from the keyboard. We use it again here, but this time to read the messages from the DataInputStream.

The next statement – while(socket != null) – tells the client that, while we have a working socket connection with the server (not null), keep running around the code in this loop.

Essentially, we're telling this thread to keep listening for any messages from the server and to append them to the 'chatBox' JTextArea as they come in.

SENDING A MESSAGE

When it comes to sending a message, however, things are much simpler – we know the client is going to send a message when the user hits the Send button (btnSend). That means all we need here is an ActionListener to listen out for that button. That launches the sendChat method with parameters 'clientNumber', 'name'



##@CLIENTCLOSED@## message to the server. As soon as the server sees this, it removes this particular client from the list using the command 'removeClientFromList(socket)', where 'socket' is the socket connection to this particular client.

Meanwhile, an integer variable 'shutDown' is set to '1' in the associated thread, which ensures the 'while()' loop here breaks off and that thread automatically shuts down.

CHAT CLIENT CODE

Because we're more interested in the threads and networking side of these apps, we've kept the Client GUI especially simple with just four main objects – a JTextArea that displays all messages coming from the server, a name JTextField for the user's name, a message JTextField for the message the user wants to send and, finally, a 'Send' button that transmits the message to the server.

plus the message to send. Scroll down and you'll see the 'sendChat()' method. It's pretty simple – we start by checking that the socket link to the server is still valid (not null) and, if so, we create a new PrintWriter object connected to the socket via an OutputStream. We then 'print' the client number, name and message to the server.

RECEIVING MESSAGES AT SERVER

If we go back briefly to the server again, this is where the server's client thread comes into play. It expects to see data come in the form of client number, client name and client message and processes it on that basis.

Any valid message that arrives is automatically and immediately sent to every client. This happens through the HomeChatServer's version of the sendChat method. The only difference from the client version is that, here, we incorporate a for-loop to instantiate a new PrintWriter object to send the username and message to each client. This is done by looping through each socket in the 'chatSockets arraylist' phonebook we talked about before.

REMOVING CLIENTS FROM LIST

ArrayLists are far more versatile than ordinary arrays and their awesomeness comes to the fore when we start removing clients from the list. When the user shuts down a client, we need to remove them from the list to ensure that we don't use resources unnecessarily, or generate errors by trying to send data on sockets that no longer exist.

The 'removeClientFromList(socket)' method allows us to use the built-in 'ArrayList.remove()' method – we just loop through the list, locate the socket that matches the one we need to remove, fire up the remove() method and we're done. Unlike an ordinary array, there's no 'hole' left in the ArrayList when an element is removed – all elements below the one removed are automatically shuffled up.

BUILDING JAR FILES

When using the chat network, you don't want to be launching the NetBeans IDE on every client computer just to load up the client app. Instead, you just need those JAR files we talked about at the start. You can also create your own in NetBeans. Ensure your code window shows the class you want to compile and press the F11 key. Click on 'Clean and Build' and within a few seconds, you're done.

To find the JAR file, head to your /documents/NetBeansProjects/<project> folder, dive into the 'dist' subfolder and it should be there, ready to go.

```
public void run() {
    try {
        Scanner in = new Scanner(socket.getInputStream());
        String messageFromClient = "";
        String clientName = "";
        String whichClient = "";
        int shutdown = 0;
        while (shutdown == 0) {
            whichClient = in.nextLine();
            clientName = in.nextLine();
            messageFromClient = in.nextLine();
            if (messageFromClient.equals("#$CLIENTCLOSED$")) {
                removeClientFromList(socket);
                serverStatus.append(new Date() + " - " + clientName + " (" + whichClient + "): has shut down. ## REMOVED ##\n");
                sendChat(clientName, "has shut down ==> Chat Network members remaining: " + chatSockets.size() + " member(s).");
                shutdown = 1;
                in.close();
            } else {
                serverStatus.append(new Date() + " - message from " + clientName + " (" + whichClient + "): " + messageFromClient + "\n");
                sendChat(clientName, messageFromClient);
            }
            serverStatus.setCaretPosition(serverStatus.getDocument().getLength());
        }
    } catch (IOException ex) {
    }
}

try {
    serverStatus.append("==== Welcome to the Home Chat Network Server =====\n");
    serverStatus.append(new Date() + " - Server started at socket 3801. ");
    serverStatus.append("Server IP Address: " + InetAddress.getLocalHost() + "\n");
    serverSocket = new ServerSocket(3801);
    while (true) {
        Socket chatSocket = serverSocket.accept();
        chatSockets.add(chatSocket);
        DataOutputStream toClient = new DataOutputStream(chatSocket.getOutputStream());
        toClient.writeInt(++clientNo);
        toClient.writeInt(chatSockets.size());
        serverStatus.append(new Date() + " - New chatter joined, number " + clientNo);
        serverStatus.append(" - " + chatSocket.getInetAddress().getHostName());
        serverStatus.append(" - " + chatSocket.getInetAddress().getHostAddress() + " (" + "\n");
        new Thread(new ClientProcessFrom(chatSocket)).start();
        sendChat("==== Chat network ====", chatSockets.size() + " member(s) : " + "====");
    }
} catch (IOException ex) {
    JOptionPane.showMessageDialog(null, "Chat server is already running!\n\nClose the existing server and relaunch.",
        "Chat server already running", JOptionPane.ERROR_MESSAGE);
    System.exit(0);
}
```

The server launches a new thread for each client and monitors all input.

The server continually loops through the while(true) loop.

```
==== Welcome to the Home Chat Network Server ====
Mon Apr 11 18:37:46 AEST 2016: Server started at socket 3801, Server IP Address: ms1wand12/192.168.0.11
Mon Apr 11 18:38:36 AEST 2016: new Home Chat member joined, number #1: hostname - WORK-PC: IP address - 192.168.0.3
Mon Apr 11 18:38:40 AEST 2016: new Home Chat member joined, number #2: hostname - WORK-PC: IP address - 192.168.0.3
Mon Apr 11 18:39:13 AEST 2016: new Home Chat member joined, number #3: hostname - LebbieYates-PC: IP address - 192.168.0.4
Mon Apr 11 18:39:24 AEST 2016 - message from Charlie (3): Hello, world!
Mon Apr 11 18:39:53 AEST 2016 - message from Adam (1): That's what I was going to say - oh, well. I'm client #1.
Mon Apr 11 18:40:08 AEST 2016 - message from Belinda (2): My client app says I'm Client #2.
Mon Apr 11 18:40:40 AEST 2016 - message from Adam (1): Tap a message, press Send, it's sent to the server and onto everyone on the chat network.
Mon Apr 11 18:40:55 AEST 2016 - message from Belinda (2): Yep, that's about right.
Mon Apr 11 18:41:28 AEST 2016 - message from Charlie (3): Sounds like fun. But, I've had enough - I'm off. Bye, everyone.
Mon Apr 11 18:41:43 AEST 2016 - Charlie (3): has shut down. ## REMOVED ##
Mon Apr 11 18:42:11 AEST 2016 - message from Belinda (2): That didn't take long! Well, I guess I'll go too. Bye, Adam.
Mon Apr 11 18:42:24 AEST 2016 - Belinda (2): has shut down. ## REMOVED ##
Mon Apr 11 18:43:05 AEST 2016 - message from Adam (1): World's shortest chat conversation? Looks like it. Bye.
Mon Apr 11 18:43:14 AEST 2016 - Adam (1): has shut down. ## REMOVED ##
```

The server app distributes messages from one client to all clients.

Just remember to first install that Java Runtime Environment on each client. To then run the JAR file, just double-click on it and it'll go. At this point, Windows 8 and 10 users may receive a Windows Firewall security alert – check the box next to 'private network' and click the 'Allow access' button.

LOTS MORE TO DO

Now before anyone blows up at our code, we're not saying this is 'the' way to build a home chat network – it's just one way. And there's plenty more we can do to improve it.

For starters, if the server crashes, all of the clients need to be restarted. The server crashing automatically closes all sockets to the clients and restarting the server cannot

reestablish previously closed sockets. However, if the client crashes, restarting it will establish a new socket with the server – but, you'll lose all messages that have been previously sent. A nicer-looking GUI wouldn't hurt either.

These are all fixable, but with more time and code. Like most software development projects, the scope can easily get out of hand the more you start seeing ways to improve things. ■

downtime

» GAMES EDITED BY TROY COLEMAN



"Enemy design is more diverse than ever; long-haired skeletal spider people sucked my face off, fire witches reduced me to ash, and the icy quadrupedal Irithyll knights chopped me up into a big bowl of frosted flakes."

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HOT PRODUCT

Dark Souls III

Dodge-rolls series fatigue and backstabs expectations.

I'm friends with a giant now. He tosses spears taller than me a thousand yards to keep a white birch safe from cursed villagers, and I can respect that. The whole village is visible from atop his tower, all its ramshackle buildings and tortured denizens whose worship of a rotten greatwood has clearly gone awry. My job is to bring the ashes of the Lords of Cinder back to their thrones to prevent the apocalypse. Maybe it'd be better off that way. This world isn't my friend.

Still, the giant is, and if he cares about a little white tree, then I should too. That's enough to keep going.

This is what makes *Dark Souls III* so profound. Sure, the thrilling combat and notoriously difficult boss battles are its skeleton, but the language and ambiguity of the world are the flesh and blood that imbue an excellent third-person action RPG with mythic authenticity. Marred only by a few performance hiccups, it's one of the most engrossing, cohesive games I've ever played.

You still kill monsters, collect souls, and use them to

level up. Dying means you lose your souls and respawn at the bonfire last rested at. You can run back to pick them up and carry on, hopefully further this time, but die before reaching them and they're gone for good.

I spent most of the game shield up, tip-toeing. Because so many more enemies can appear on screen now, very cautious play is rewarded. Once, I ran into ten armed undead villagers, a corpse dog or two, and a beefy spellcaster. With a lot to deal with at once, I prioritised enemies, studied the arena, and dipped into my arsenal more often than in previous *Dark Souls* games. In this instance, I could light up a gunpowder barrel with my pyro's fireball, skirt the edges of the arena to take out the smaller enemies, then focus on the spellcaster.

Attacks animate faster, but every swing and dodge roll is still an uninterrupted commitment. If I died, it was because I rushed into the fray too soon or wasn't properly outfitted.

WHAT FRESH HELL

Enemy design is more diverse than ever; long-

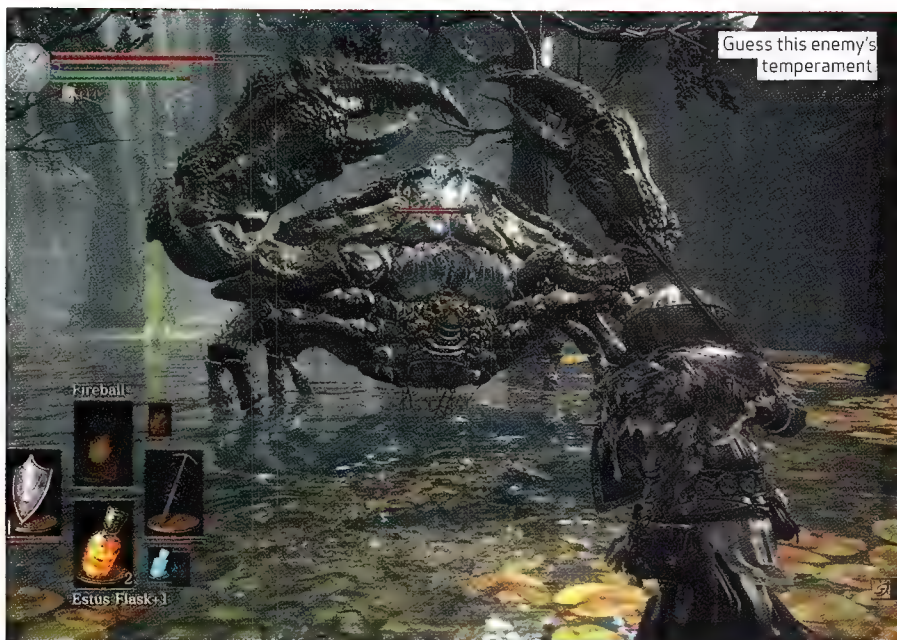
haired skeletal spider people sucked my face off, fire witches reduced me to ash, and the icy quadrupedal Irithyll knights chopped me up into a big bowl of frosted flakes. Alone, they're a challenge, but I rarely found a baddie without a buddy. Well-paced bonfires and shortcuts mitigate frustration.

Dark Souls' difficulty has always been in service of building on themes of despair, not challenge for the sake of ego. This time, the game plays around with boss design to that end, throwing in a few more thematically, mechanically playful opponents. Some are monstrosities with multiple stages that change pace in an instant. Others are pitiable opponents that made me wish I could show mercy. Some took a few tries, others closer to two hours. No matter the difficulty, every killing blow threw my heart at my ribs. They're challenging, animated with ferocity and elegance, and scored by a choral orchestra that expands on their themes and emotional backdrops.

Whether the deathblow is delivered by the fungal arm

of a rotten greatwood or the jagged teeth of a rat, failure encourages experimentation. Should I dip into the massive selection of weapons and armour, give a few miracles a whirl, or come back later? I almost didn't finish the game in time because I liked tinkering with my gear sets so much, even if it can be a clumsy battle with the UI. I found over 50 weapons, 20 armour sets, and about 40 rings in my first playthrough – 'new game plus' promises even more. I hardly touched sorcery or advanced pyromancy's long list of spells. Bows are also much more viable this time around, easy to equip and quick to fire. I can hardly comprehend the variability in character builds, which is especially exciting for fans of PvP.

To start harassing or helping other players, you first need to consume an Ember. These raise your health, but also open you up to random invasions. Covenants – hidden online guilds – come with their own lore and PvP goals. One is essentially on-call bodyguard duty. If a player in your covenant is invaded by another, you can join their game and hunt the hunters. My favourite covenant rewards successful invasions with player tongues,



which I can hand over to my covenant leader to reallocate my stats or change my appearance. I was only invaded a handful of times, and several were scripted NPC invasions, but each was a frenzied dance, prolonged by Estus Flask heals that left my opponents vulnerable for a few seconds, but outpaced the speed at which I could damage them. Healing is no longer certain death, but a very desperate manoeuvre to reset the playing field.

PvP remains a spontaneous layer over an already tense, unpredictable journey, but the community needs time to dig into PvP builds before they can establish the meta.

Beyond the cursed undead village, I can see the fog blanketing the Irithyll Valley, its ruins resting below Archdragon Peak. A series of fetid swamps rounds out the panorama, lit by three towers of fire below the bridge to Lothric Castle. There's no in-game map, but sweeping vistas crop up often, and not just because

they're pretty. They're how I know where to go.

Unlike the first game, the areas are fairly isolated, joined by a coil that snakes around the world with a few major forks. Each is a massive maze, with more secrets than the space between your couch cushions. One particularly difficult stretch of combat killed me more times than I can recall, until I looked into the crevasse I was sidling around and saw I could skip the entire sequence by hopping down a few platforms. Damn.

It was one of many reminders to poke around innocuous corners; I couldn't find a space that didn't reveal an item, a hidden character, or a story-related prop. *Dark Souls III* builds a world and an entire history through a density of implicit information not possible in the previous games. There's an early string of environments affected by Aldrich, a katamari of sentient goo leaving sickly signposts throughout

Lothric. Before I met Aldrich, I saw where he'd been: a small stone tableau depicting his congregation, the unfaltering dedication of his sworn cathedral knights (to pursue and kill me), throngs of walking corpses vomiting up maggots, the ambient hum of whales in a forest. It's all there to build the myth of Aldrich, but I had to draw the connections.

THE ZERO'S JOURNEY

In my pursuit of this, I stumbled into a few hidden levels so easy to miss that it's hard to believe time was spent filling them at all. They feature unique enemies, complex bosses (arguably one of the best in the entire series), and lore that many players will never see, exhibiting a faith in the playerbase to exhaustively discuss and catalogue every detail.

The mystery carries over into the characters strewn about the world. Each carries a personal storyline that can play out differently depending on their

relationships with other NPCs and a few branching decision points. Moral dilemmas, tragedy and corruption pull at every one.

The added fidelity in *Dark Souls III* could have just been a simple upgrade in texture detail, but FromSoftware treat the extra space like a wider canvas, pushing their themes and story through every possible avenue.

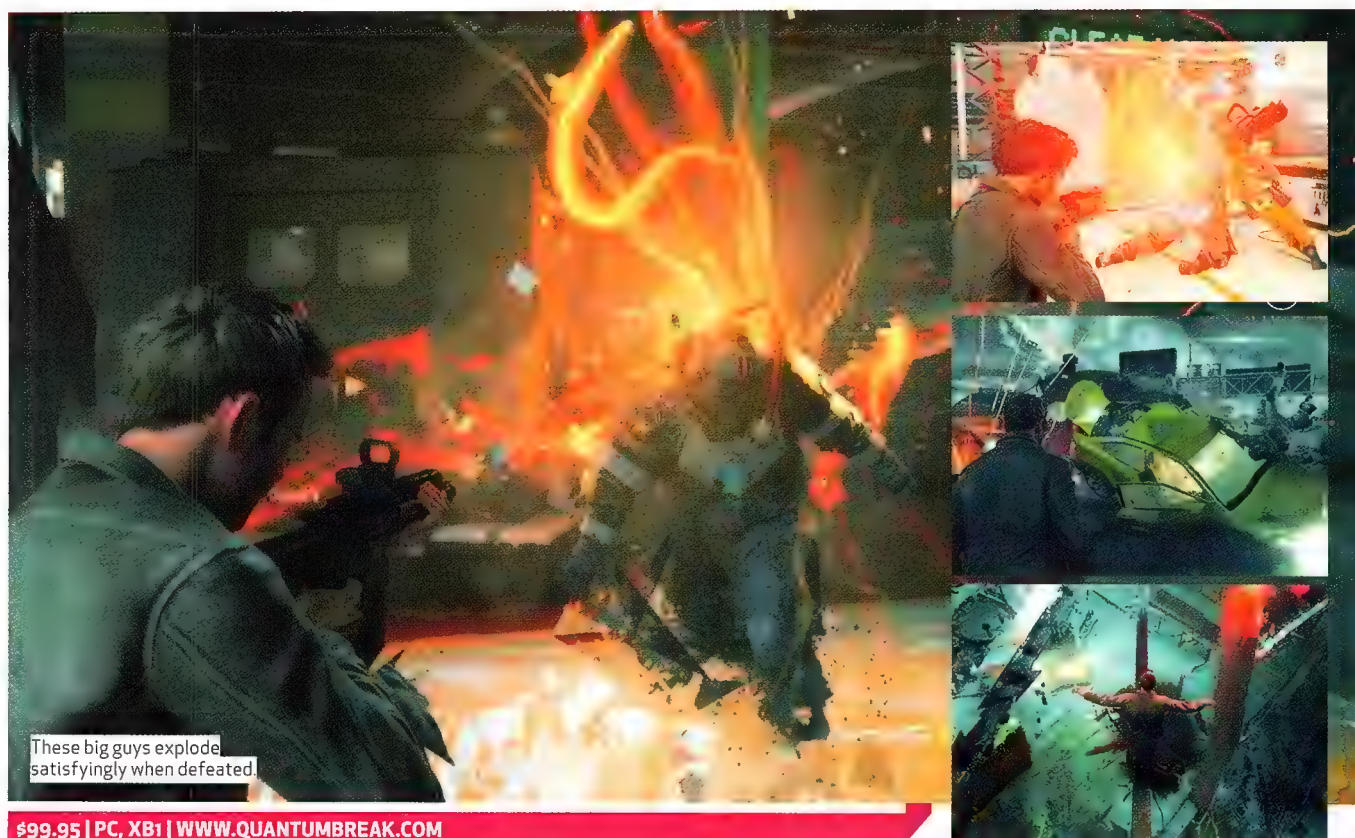
I was challenged to read environments like a novel, to empathise with Lothric's imperfect inhabitants, and to ask whether or not anything was worth saving. But there are no easy answers here, only 40-plus hours of tense action, awe-inspiring exploration, death, and big, bleak, beautiful questions.

■ James Davenport

Verdict

Sprawling level design, thrilling combat and masterful storytelling make this the best *Dark Souls* yet.





These big guys explode satisfyingly when defeated.

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Quantum Break

Another stylish, story-heavy shooter, and an uncharacteristically shoddy PC port.

A physics experiment goes horribly wrong, granting everyman Jack Joyce time-bending powers. He can deflect bullets, teleport, freeze or reverse time, and unleash deadly bursts of energy – abilities that come in handy when he learns he's on a mission to save the world. But the evil Monarch Corporation has other ideas, and Joyce finds himself being hunted across the fictional East Coast city of Riverport by a ruthless private army.

Quantum Break is a story-heavy action game by *Max Payne* creator Remedy. As well as a ten-hour campaign featuring the kind of cinematic combat the Finnish studio is known for, episodes of a live-action TV show play between acts, and the scenes change – sometimes dramatically, sometimes subtly – according to in-game decisions you make and

things you interact with. It's an interesting idea in theory, but you quickly realise your impact on the outcome of the show is negligible, and that the game attached to it is a disappointingly average shooter.

Primarily a third-person shooter, you spend a good portion of the game firing guns at people who are also firing guns at you. But it's not really a cover shooter, at least in the conventional sense. Joyce crouches automatically behind objects of a certain height, but firing a gun makes him stand up, and you can't pin yourself against surfaces or blind-fire around them. This is, I think, to encourage you to keep moving and take advantage of his time powers, rather than playing it like *Gears of War*.

Joyce's dash ability lets him basically teleport across the level for a short distance – and if you aim your gun at the end, time will briefly slow down to give you a

chance to line up a headshot. Or you can toss a bubble of energy to slow an enemy down, then fire into it to create a throbbing, fiery mass of bullets that are simultaneously unleashed when it bursts. The powers look amazing, especially the way the level fragments and ripples around you when you use them, and I like how you can experiment by combining different ones. But once the initial buzz wears off, they feel slightly gimmicky, and fail to make up for the fact that *Quantum Break* is, really, a fairly basic shooter.

The production values are incredible throughout, but fail to hide the fact that, underneath all the gloss, the game is a completely prosaic action game. Remedy has a track record of developing quality PC versions of its games, but *Quantum Break* – one of the first big releases for Microsoft's Universal Windows Platform – runs poorly, even on high-end

systems. It's incredibly demanding (or badly optimised, depending on how you look at it), and on low settings at 1080p with a GTX 970, it struggles to maintain a steady framerate.

Quantum Break has some genuinely brilliant set-pieces and a better story than most action games. But overall, it's an unremarkable shooter that tries to distract you from its lack of ideas with dazzling production values and polish.

Remedy fundamentally knows how to make an exciting action game, and *Quantum Break* has its moments. But they're overshadowed by dumb platforming, uninspiring enemy design and a lacklustre PC port.

■ Andy Kelly

Verdict

An average shooter tied to a confident story, but the TV show is ultimately an expensive, if entertaining, gimmick.





FROM US\$19.99 | PC, XB1, PS4 | WWW.HEART-MACHINE.COM

Hyper Light Drifter

Beautiful but challenging.

The drifter, a mute warrior draped in a red cloak and wielding a sword of light, is an enigma. He roams a broken landscape searching for something, but it's not clear what. Occasionally, he hunches over and coughs up blood, which causes the screen to glitch and flicker. There's a beguiling mystery about this figure, like the nameless gunslinger in a Western or a wandering samurai, and the same can be said of *Hyper Light Drifter* as a whole.

It's a world of strange machines, ethereal forests, ancient temples and lifeless, overgrown robots. An evocative intro shows us glimpses of a cataclysmic event — a gleaming futuristic city disappearing in a flash of explosive light — and this seems to be the aftermath. A ruined place littered with the remains of forgotten technology. It's not a dead world, however — there are people and creatures everywhere, some of which are friendly — but it feels like you're living in the wake of a disaster of some kind.

It's a beautiful post-apocalypse, brought to life by

a vivid palette and intricate pixel art. A haunting ambient score by Rich 'Disasterpeace' Vreeland adds to the atmosphere, subtly changing to reflect your surroundings.

Artistically, it's a triumph, but the considered, delicate aesthetic is somewhat misleading. Mostly *Hyper Light Drifter* is a punishing, fast-paced action game.

Hyper Light Drifter is all about the combat. Its varied bestiary of enemies is relentlessly aggressive, but they have attack patterns that can be learned and exploited. It's when you're facing several different types at once, usually in confined, trap-filled spaces, that things get difficult. Timing and carefully observing your opponent are key to surviving a battle. It's almost like a puzzle game, knowing which enemies to attack first, where to move, and when to use your limited health consumables.

Dungeons hide the most satisfying combat in the game. Their layouts change dynamically around you, forcing you to constantly change your tactics.

This is a game where enduring persistent failure

is the only way to get good, and a lot of people won't have the patience to get through some of its more gruelling battles — particularly the fiendishly difficult boss fights.

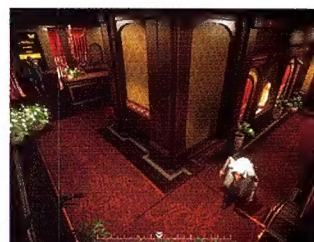
Ultimately, how you respond to these difficulty spikes will depend on your temperament. If you're the type of gamer who has the fortitude to try things over and over until you master them, *Hyper Light Drifter* is for you. If not, you'll almost certainly give up after a few hours.

The exhilaration of clearing a dungeon with only a sliver of health is worth chasing. But the unwavering difficulty — especially the bosses — makes it an experience for a very specific type of gamer. If you have the will to overcome its many trials, you'll find a rewarding, uncompromising action game. If not, you might feel like you're banging your head against an incredibly stylish brick wall.

■ Andy Kelly

Verdict

Artistic, beautiful and uncompromising, *Hyper Light Drifter* is as rewarding as it is frustrating.



République

The art of keeping Hope alive.

FROM US\$24.99 | PS4, PC
WWW.CAMOUFLAJ.COM

This dystopian saga was originally a mobile game — but always seemed destined for something greater, hence the leap to PS4. It challenges — both emotionally, and in gaming terms — from early on.

Staring into the panicked face of a girl named Hope, you learn she's going to be 'erased' for having a book that supposedly infects young minds. Hope is whisked away for a rough inquisition, observed from the lens of a nearby security camera. That leaves you with numerous questions, and *République*'s measured pacing throughout five episodes — as well as subtle narrative clues in the form of posters, voicemails and newspaper cuttings — makes for some excellent story-telling throughout. The main idea is to bust Hope out of the building, eluding Prizrak patrols. But there's no real sense of urgency when you realise that getting caught simply means being tossed in a holding cell you can easily escape. The fun, however, clearly lies in not getting caught at all. What's more, sneaking around is made interesting by switching between Hope and the cameras lining the corridors. This creates an unlikely synergy between man and machine in a 'big brother' state, especially when you can seal off doors and override locks to aid our escapee.

Despite its awkwardness and repetitive scenarios, *République* has heart and a rich, slow burn plot that keeps you guessing.

■ Rhianon Rees

downtime » chip chat

» CARMEL SEALEY REPORTS ON THE LIGHTER SIDE OF TECH NEWS



The secret to movement in VR?

Keep it in your pants.

The problem of nausea associated with using virtual reality is widely discussed, but the suggested solutions are few and far between, and oftentimes expensive (walking-simulation treadmills, I'm looking at you). Ryan Sullivan thinks he may have come up with an accessible and simple solution. "Your hips always point the way you are running," he said, so why not put your HTC Vive controller down your trousers? Logical. While this is apparently a little uncomfortable and no doubt embarrassing, the Vive's tracking system is advanced enough to detect the orientation of the gamer's hips via the circular part of the controller. Okay, you don't have to shove it down your pants — fixing it securely on the outside of your trousers in a belt works fine, too.



Rich kids of Instagram

GETTING THEIR PARENTS CONVICTED.

Trawl through Instagram for long enough and you'll no doubt stumble upon pictures of wealthy young people flaunting their parents' riches, be it expensive jewellery, multi-million dollar yachts, private jets, helicopters, mansions, supercars, baths of champagne (yep, apparently a thing) or just piles of cash. Cyber-security firms are now using posts like these as evidence in litigation cases, to catch out people's undeclared offshore assets. According to the Managing Director of K2 Intelligence in London, social media is now, in fact, the company's "first port of call". Investigators often use an individual's geo-tags (and those of their children) to give them locations of potential hidden assets. In many cases, they cross-reference this information with land registries and discover property they can then take to court.



Robot waiters get fired

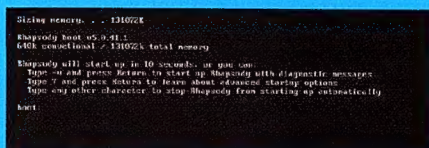
AS THEY PROVE DISASTROUS FOR CHINESE RESTAURANT CHAIN.

Though robot technology has taken great leaps in recent years, there are some things humans are just better at doing — at the moment, anyway — as two restaurants in China unfortunately learnt the hard way. Restaurant chain Heweilai decided to try using automats to wait on its clientele; however, it became quickly apparent that they were vastly overestimating the robots' abilities, as they failed to do even the most basic tasks, namely take orders and last a whole shift. The robots (costing US\$7,000 a pop) also cost more to buy and maintain than employing actual human staff. Heweilai has consequently closed all but one of its stores and binned its faulty metal workforce.

Nostalgic for your old PC or Mac?

HERE'S THE CURE.

"What do you want the computer to do?" "Seconds until restart: 99" "Do you really want to restart workbench?" "Are you sure that you want to close all windows and active programs and restart your system?" These prompts are probably reminding you of the computing days of yore. Well, now there's a way to relive what it was like to shut down and restart your old Macintosh, Unix system or Windows computer with The Restart Page (www.therestartpage.com). Why would you want to? Why not? Simply clicking 'OK', 'Restart' or 'Yes' in one of the numerous window prompts instantly transports you (within the browser — don't worry!) to the beauty of Nostalgia Road. Danger: drooling may occur.



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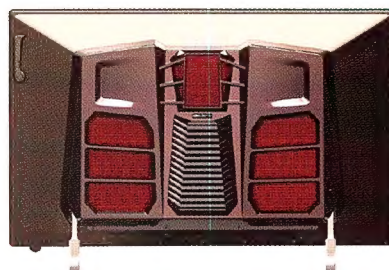
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